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# Receiving Water Quality Monitoring Report

Pago Pago Harbor, American Samoa  
November 1996 Sampling

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Prepared for

StarKist Samoa  
NPDES Permit AS0000019  
and  
VCS Samoa Packing  
NPDES Permit AS0000027

Submitted to

U.S. Environmental Protection Agency  
and  
American Samoa Environmental Protection Agency

Prepared by

**CHM HILL**  
and  
**gdc**

7 March 1997

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# **1. INTRODUCTION**

This report describes the second semi-annual Pago Pago Harbor water quality monitoring field measurements done under the revised NPDES permit condition (E) for VCS Samoa Packing and StarKist Samoa. The letter from the U.S. Environmental Protection Agency implementing the changes in the permits, and the revised permit condition are included as Appendix I. The revisions apply to both permits for discharge through the Joint Cannery Outfall (JCO): VCS Samoa Packing holds NPDES permit A30000027 and StarKist Samoa holds NPDES permit AS0000019. The overall purpose of this study and the purpose of this report, a description of the study site, a brief background of the water quality monitoring work done in the Harbor, and the scope and organization of this report are described below in this section of the report. Following sections of the report describe the field data collection, the laboratory results of samples collected, and conclusions and recommendations based on the results.

## **1.1 PURPOSE**

The purpose of the Receiving Water Quality Monitoring Program is, as described in the permit, "to determine compliance with water quality standards". To achieve this the program must, as described in the permit, "document water quality at the outfall, at areas near the zone of initial dilution (ZID) and zone of mixing (ZOM) boundaries, at areas beyond these zones where discharge impacts might reasonably be expected, and at reference/control areas". The purpose of this report is to document the second set of data, collected during November 1996, and to evaluate these data in terms of compliance with water quality standards. The second monitoring episode was originally scheduled for October 1996, but was delayed with the approval of USEPA

## **1.2 STUDY LOCATION**

Water quality measurements and samples were obtained throughout Pago Pago Harbor, Tutuila Island, American Samoa. The island is located approximately 2300 miles southwest of Hawaii, 1600 miles northeast of New Zealand, and 1000 miles south of the equator at latitude 14° 17' S and longitude 171° 40' W (approximately). The general location is shown in Figure 1-1. The harbor is approximately 15,000 feet long with the entrance to the south. The outer harbor trends north-south with widths varying between 3000 and 6000 feet. The inner harbor trends east-west with the head of the harbor to the west and ranges from less than 1000 to about 3000 feet wide. Figure 1-2 shows the general harbor morphology. Maximum depths along a cross section range from less than 60 to over 200 feet, with fringing reefs periodically exposed at low tide throughout the middle and outer harbor areas.

The climate is tropical with about 200 inches of rainfall annually, air temperatures typically between 70 and 90°F, and high humidity. Orographic effects create higher rainfall in the

vicinity of the harbor than at other locations on the Island. The watershed of the harbor is small relative to the harbor size with about 4.9 mi<sup>2</sup> of drainage area compared to about 2.4 mi<sup>2</sup> of water surface area. Therefore, the harbor is typically a marine dominated system with depressed salinities normally found only very close to stream mouths.

Tides are semi-diurnal with a range of about 2.5 feet and little diurnal inequality. The circulation in the Harbor is mainly wind driven with both tidal and freshwater influences generally very small except at extremely localized sites. Winds are usually from the east and southeast and are from this direction most of the time during the tradewind season, which is typically April/May through October/November. During November/December through March/April the east to southeast winds still predominate but a northwest to northeast component becomes more prevalent (the non-tradewind season).

The tuna canneries discharge through the JCO which terminates in a mulitport diffuser at a depth of approximately 176 feet in the outer harbor (see Figure 1-3). Typical flows through the outfall are approximately 2 mgd. The discharge is in the center of a mixing zone for total nitrogen (TN) and total phosphorous (TP) as shown in Figure 1-3. A small mixing zone for ammonia has also been established and is defined within 12 meters of the diffuser discharge ports.

### 1.3 BACKGROUND

Prior to the implementation of high strength waste segregation and outfall relocation, the canneries discharged treated wastewater into the inner harbor though two outfalls. These outfalls terminated in about 80 feet of water in open-ended pipes without diffusers. In August 1990 both canneries started high strength waste segregation and offshore ocean disposal of the high strength waste streams (those process streams highest in nitrogen, phosphorous, suspended solids, and BOD). In February 1992 both canneries began discharging treated wastewater (without the high strength waste component) through a single outfall, relocated approximately 8400 feet seaward from the previous discharge point, at about the 180-foot contour, in the outer harbor. The new outfall terminates in a diffuser consisting of four active and two inactive ports.

The current NPDES permits for both canneries, which became effective in October 1992, required monthly monitoring of water quality parameters, with emphasis on nutrients, at established monitoring stations throughout the harbor. This monitoring had been carried out by the American Samoa Environmental Protection Agency (ASEPA). In November 1995, USEPA revised the permit condition for reasons given in the notification of revision (Appendix I). The revised water quality monitoring (Appendix I) is similar to, and extends the usefulness of, the original monitoring condition. The major changes in the permit condition include:

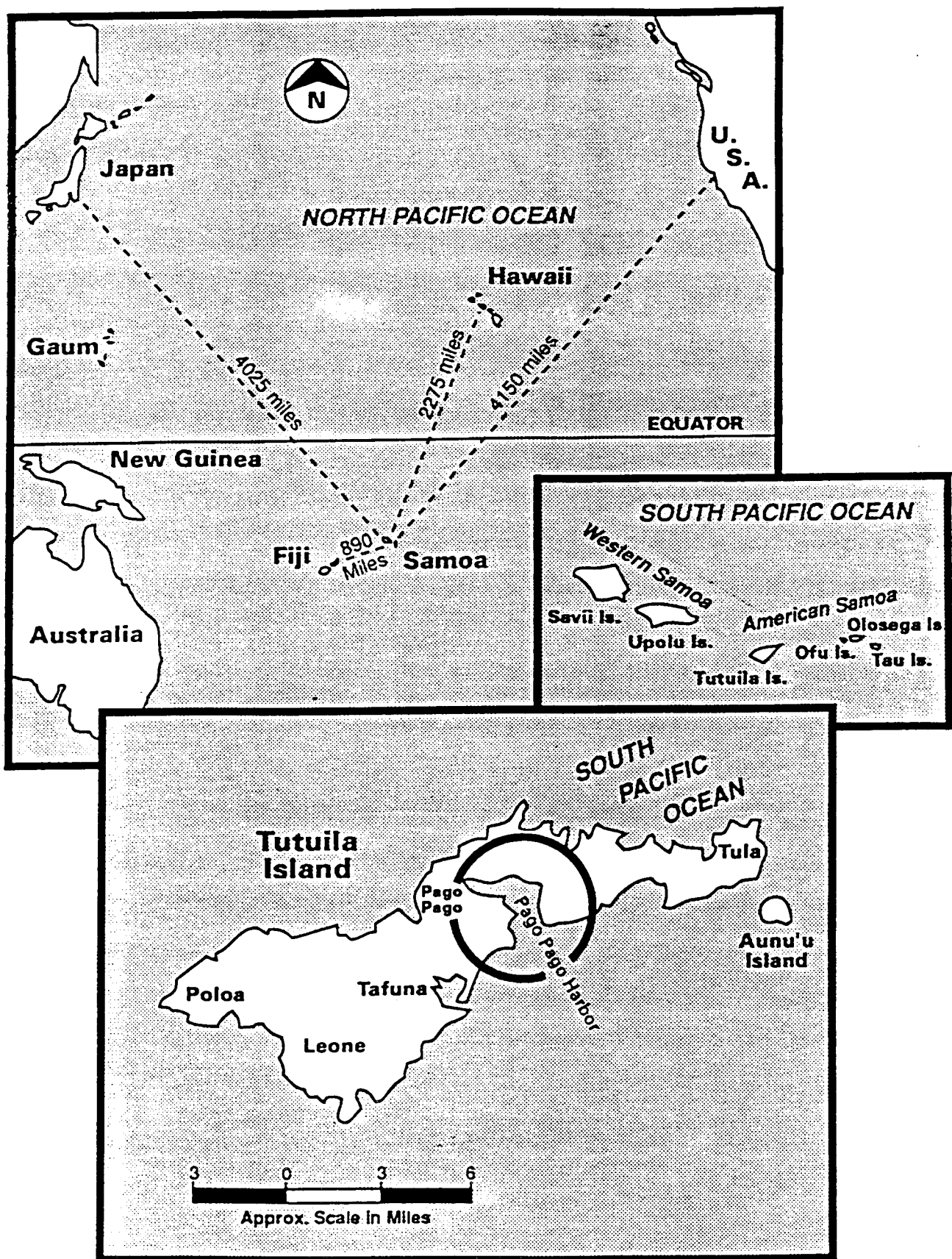
- The frequency of sampling was reduced from monthly to semi-annually
- The number of sampling locations was increased from 17 to 20

- The number of sampling depths was changed from three to a maximum six at 30 foot
- Continuous vertical profiles of temperature, salinity, dissolved oxygen, pH, and turbidity, rather than grab samples, are now required  
increments plus near bottom (with a minimum of three samples in shallow water)
- Suspended solids was removed from the list of analytes
- Sampling for zinc and copper was added for seven locations at specified depths

The first of the monitoring episodes required by the revised permit was conducted in March 1996. This report describes the second monitoring episode required by the revised permit, which was conducted in November 1998.

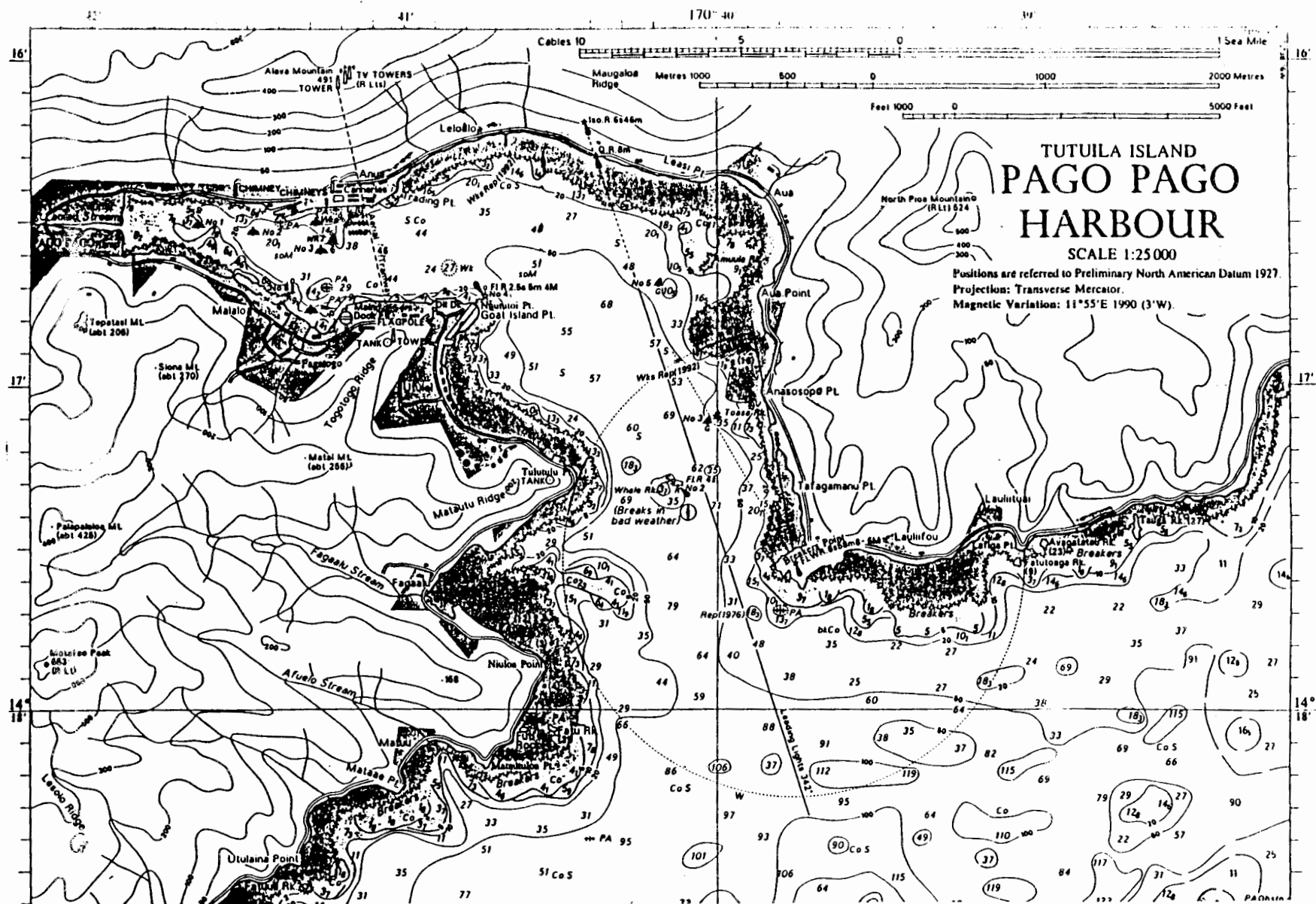
## **1.4 SCOPE AND ORGANIZATION OF REPORT**

The following sections of this report describe the field data collection (Section 2), summarize the data acquired (Section 3), and provide conclusions and recommendations (if any) based on the field data collection and results (Section 4). Section 2 includes specific information on sample station locations and times, field methods, and describes any deviations from the intended study plan. Section 3 presents summaries of field measurements and laboratory results with detailed information referenced to appendices when appropriate. Section 4 includes an evaluation of compliance with American Samoa Water Quality Standards (ASWQS) based on the data collected, and presents recommendations for changes in methodology, sampling strategies, or other requirements as appropriate. References are provided (Section 5) and appendices are included describing the specifics of the permit condition, the study and analysis plan and the revised standard operating procedures (SAP/SOP), and detailed data supplements for field measurements and laboratory analyses.

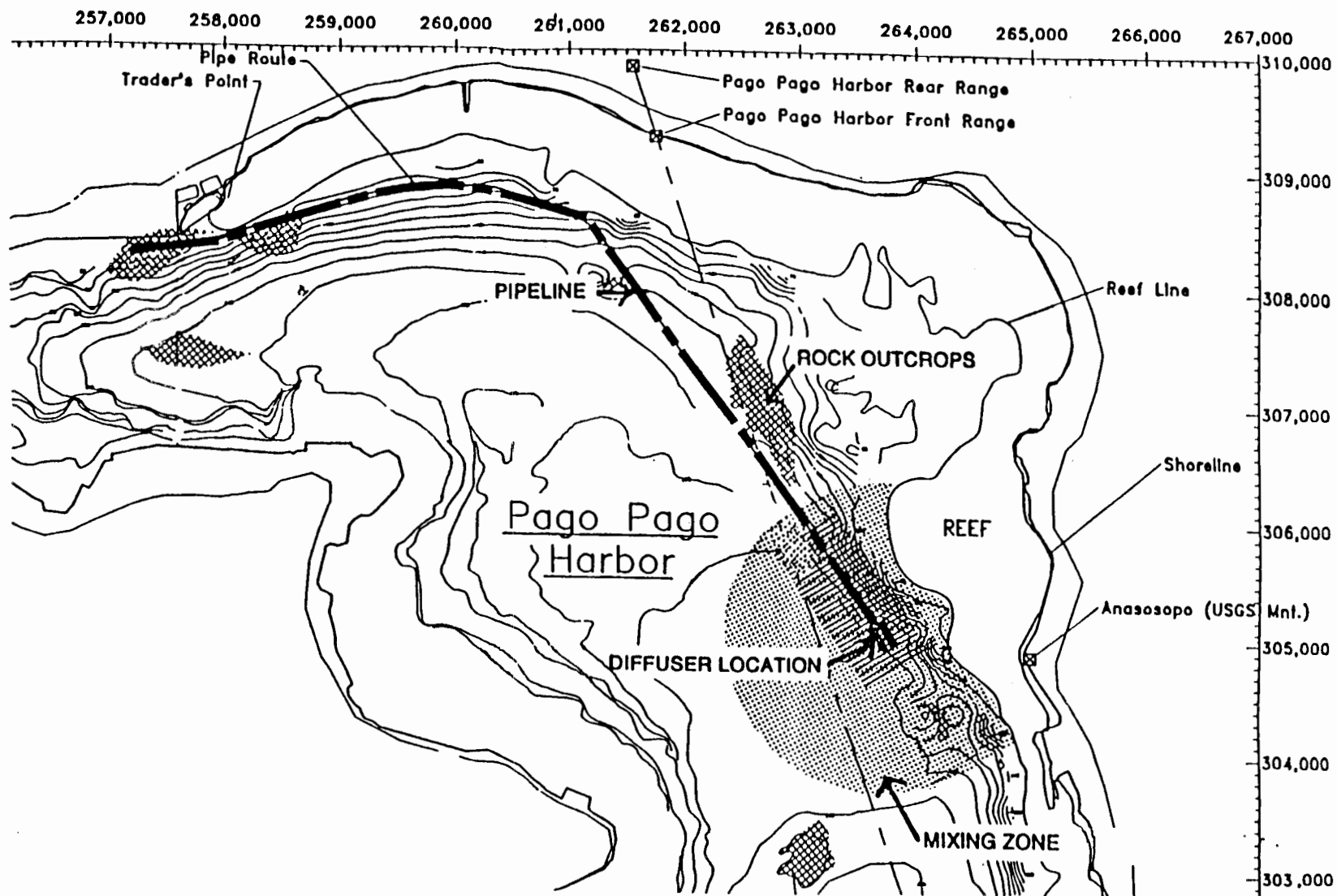


**Figure 1-1**  
**Overview of Study Site**





**Figure 1-2  
Pago Pago Harbor**



**Figure 1-3**  
**Outfall and Mixing Zone**  
**Location**

## **2. FIELD DATA COLLECTION**

A description of the field data collection during November 1996, including the methods used for field measurements and sample collection are described below. The types of data collected and the locations, dates, and times of measurements and sample collection are summarized. Deviations from the SAP/SOP are listed and discussed.

### **2.1 GENERAL DESCRIPTION**

The field work was conducted between 19 November and 23 November 1996. The activities conducted during this time period included:

- 19 November - Sampling at stations 11, 11A, 12, and 13
- 20 November - Sampling at stations 9, 9A, 10, 10A, 15, and 16
- 21 November - Sampling at stations 5, 5A, 7, 8, 8A, 14, and 18
- 22 November - Sampling at stations 6, 6A, and 17
- 23 November - Continuous profile hydrographic casts made at all stations

During sampling at designated stations water samples were collected for laboratory analysis using standard water sampling bottles (Niskin type bottles). Secchi depth and total water depth were measured at each station. Profile casts were made on November 23<sup>rd</sup>. The dissolved oxygen (DO) probe on the profiling instrument was checked prior to sampling, and was found to give unreliable readings. Attempts to field service the probe were unsuccessful. Therefore, DO was measured for each individual grab sample (at each station and each depth sampled) using a YSI DO meter (temperature and salinity internally compensated). pH was measured either in the field during the collection of individual grab samples, or using a subsample from the chlorophyll-a sample at the time of filtering as described below.

The continuous profile hydrographic casts were done using a SeaBird conductivity, temperature, depth (CTD) instrument also equipped with DO, and turbidity probes. The DO probe was not functioning, as mentioned above, and the pH probe was not available. The meter records every 0.5 seconds on both the downcast and upcast. It is equipped with a pump to provide for sufficient flushing past the sensors.

The meteorological conditions during sampling was as follows:

- 19 November (AM) - Wind from SE at 10 knots, mostly cloudy to heavy overcast
- 19 November (PM) - Wind from SE at 10 knots, mostly cloudy
- 20 November (AM) - Wind from S to SE at 5 to 10 knots, partly to mostly cloudy
- 20 November (PM) - Wind from S to SE at 5 to 10 knots, partly to mostly cloudy

- 21 November (AM) - Wind from S to SE at 5-15 knots, partly cloudy, seas at entrance 6 to 10 feet
- 21 November (PM) - Wind from SE 5-10 knots, mostly cloudy
- 22 November (AM) - Wind from SE 5-10 knots, mostly cloudy
- 22 November (PM) - Wind from SE 5-10 knots, mostly cloudy
- 23 November (AM) - Wind calm to 5 knots from N, seas decreased to 3 to 5 feet, partly cloudy
- 23 November (PM) - Same as AM

Station locations are specified in the permit both by latitude and longitude and graphically. The problems with station specification associated with the differences between various map datums and the use of GPS was described in the report on the March 1996 sampling episode. We have recorded, and permanently stored, the WGS 1984 coordinates of the stations actually occupied for the March 1996 sampling and will use the same coordinates for all future sampling episodes. The WGS coordinates occupied, and the times of station occupation, are given in Table 2-1. Figure 2-1 shows the relative locations of the stations occupied for this study.

## 2.2 DESCRIPTION OF FIELD METHODS

Direct field measurements included water depth, Secchi depth, and DO, in addition pH was measured using subsamples of each grab sample. These measurements were conducted as follows:

- Water depth was measured using a non-recording portable fathometer which was occasionally checked by observing the signal produced as the Secchi disk or the SeaBird were lowered and raised through the water column
- Secchi depth was determined by using a 6" diameter black and white (quartered) Secchi disk lowered through the water column on a measured line
- DO was measured using aliquots of each sample as collected in the field using a YSI Model 50B meter following the manufactures instructions for use of the meter; the meter and probe were field calibrated before and after the sampling
- pH was measured either in the field as samples were collected or using aliquots of grab samples collected for chlorophyll-a analysis using an Orion Model 250A pH meter. These samples are stored on ice and later filtered, a small subsample was used for the pH measurement.

As described above, conductivity, temperature, depth (pressure), and turbidity were measured using an internally recording profiling instrument (SeaBird CDT) which had been calibrated by

the manufacturer prior to shipment to American Samoa. Salinity and sea water density were calculated from conductivity and temperature using the SeaBird supplied software.

Water samples were collected using a Niskin type sampling bottle from each depth specified in the permit (depths of collection at each station are shown in Table 2-1). The collection bottle was lowered to the appropriate depth using a measured line and allowed to hang for a minimum of 1 minute. A messenger was dropped down the line and the bottle was retrieved after being tripped by the messenger. Sample bottles as described in Table 2-2 were immediately filled and preserved as indicated in the table, stored on ice, and prepared for shipment to the laboratory as described in the SAP/SOP (Appendix II). In addition, a minimum of two liters was collected for chlorophyll-a analysis. The chlorophyll samples were later filtered through a Whatman grade GF/F glass fiber filter (0.7 microns) using a vacuum pump apparatus. The filters were treated with manganese sulfate as a preservative, frozen, and then sent to the laboratory for analysis.

## **2.3 DEVIATIONS FROM THE STUDY PLAN**

As in any field data collection, problems and required solutions in the field, interpretation of the guidelines being used, weather, equipment malfunctions, and a variety of other factors may lead to deviations from the study plan. There were only minor deviations during this episode of field data collection which either had no substantial effect on the data recovered and in some cases actually enhanced the objectives of the study. The identified deviations for this study included the following:

- Discrete grab samples for measuring turbidity were collected, in addition to the profile data required by the permit, at selected stations in and around the mixing zone including stations 8, 8A, 14, 15, 16, 17, and 18
- DO was measured for all discrete grab samples for all stations occupied (and data from the continuous profile was discarded)
- pH was measured for all grab samples rather than as a continuous vertical profile
- Extra depths were sampled at Stations 6A and 15 (one additional depth at each station)

Most of the actions listed above were used to verify, and adjust as necessary, data being taken by the vertical profiling (CTD) instrument.

**Table 2-1**  
**PAGO PAGO HARBOR WATER QUALITY MONITORING**  
**STATION OCCUPATION SUMMARY**  
**November 1996**

Station Number	Sample Collection		CTD Casts <sup>1</sup>		Latitude 14° S <sup>2</sup>	Longitude 170° W <sup>2</sup>	Water Depth <sup>3</sup>	Secchi Depth <sup>4</sup>	Sampling Depths
	Date	Time	Date	Time	(minutes)	(minutes)	(feet)	(feet)	(feet)
<b>TRANSITION ZONE</b>									
5	11/21	09:45	11/23	11:15	17.713	39.733	240	36	S, 30, 60, 90, 120, B
5A	11/21	10:30	11/23	11:25	18.045	40.393	220	33	S, 30, 60, 90, 120, B
<b>OUTER HARBOR</b>									
6	11/22	10:00	11/23	15:00	17.211	40.298	201	25	S, 30, 60, 90, 120, B
6A	11/22	10:30	11/23	15:10	17.316	40.582	102	30	S, 30, 60, B
7	11/21	11:45	11/23	11:05	17.226	39.878	127	23	S, 30, 60, 90, B
8	11/21	15:45	11/23	10:50	16.843	40.098	170	18	S, 30, 60, 90, 120, B
18	11/21	11:15	11/23	11:00	17.092	40.041	192	21	S, 30, 60, 90, 120, B
<b>MIDDLE HARBOR</b>									
8A	11/21	16:15	11/23	10:30	16.826	40.150	173	20	S, 30, 60, 90, 120, B
9	11/20	12:00	11/23	14:30	16.562	40.194	128	31	S, 30, 60, 90, B
9A	11/20	11:00	11/23	14:20	16.293	40.559	130	28	S, 30, 60, 90, B
10	11/20	12:45	11/23	14:40	16.755	40.637	165	23	S, 30, 60, 90, 120, B
10A	11/20	13:30	11/23	14:45	16.997	40.451	123	23	S, 30, 60, 90, B
14	11/21	15:15	11/23	10:35	16.911	40.065	178	20	S, 30, 60, 90, 120, B
15	11/20	16:30	11/23	10:15	16.584	40.116	92	25	S, 30, 60, B
16	11/20	17:15	11/23	14:50	16.891	40.354	193	21	S, 30, 60, 90, 120, B
17	11/22	09:30	11/23	10:45	16.804	40.086	82	28	S, 30, B
<b>INNER HARBOR</b>									
11	11/19	16:30	11/23	11:45	16.480	40.947	164	20	S, 30, 60, 90, 120, B
11A	11/19	16:00	11/23	11:55	16.464	41.151	139	20	S, 30, 60, 90, B
12	11/19	15:30	11/23	12:05	16.449	41.376	64	18	S, 30, B
13	11/19	15:00	11/23	12:10	16.304	41.841	29	15	S, 15, B

**Notes:**

<sup>1</sup> CDT casts were taken on the day following the final sample collection, and were all done on the same day (23 November 96)

<sup>2</sup> Coordinates are as recorded by GPS using the WGS coordinate system (see text for additional details).

<sup>3</sup> Water depths as recorded on the day of sample collection, correspondence with the day of the CTD casts is typically within a few feet.

<sup>4</sup> (S) = sunny; (Sh) = shadows and/or low sun angle

**Table 2-2**  
**PAGO PAGO HARBOR WATER QUALITY MONITORING**  
**SAMPLE ANALYSIS AND HANDLING PROCEDURES**  
**November 1996**

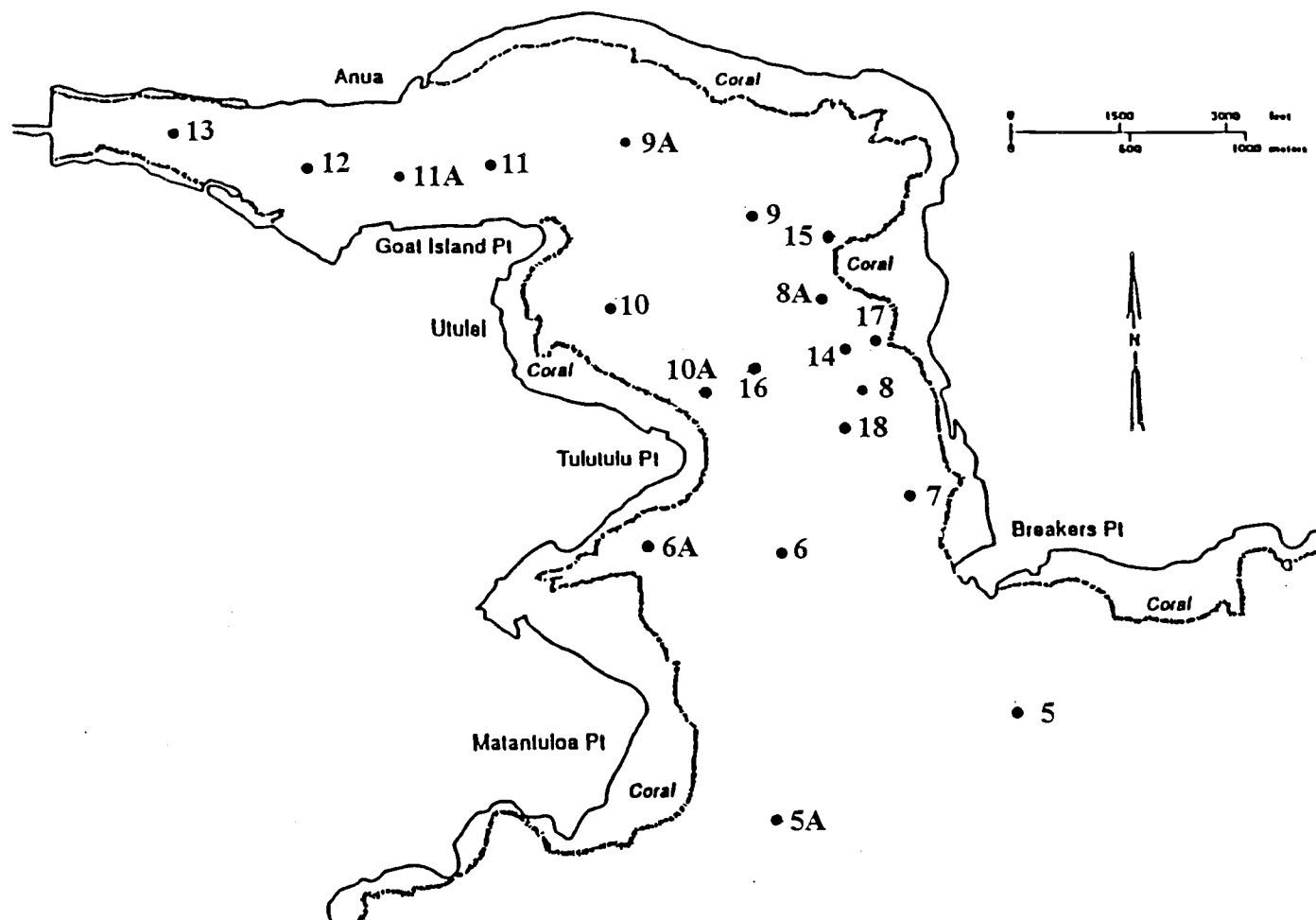
PARAMETER	REQUESTED ANALYTICAL METHOD	REQUESTED REPORTING DETECTION LIMIT	SAMPLE HOLDING TIME	SAMPLE CONTAINER	SAMPLE PRESERVATION
Temperature	Field Probe	0.1°C	N/A	N/A	none
Salinity	Field Probe	0.1 PSU	N/A	N/A	none
Dissolved O <sub>2</sub>	Field Probe	0.1 mg/l	N/A	N/A	none
pH	Field Probe	0.1 SU	N/A	N/A	none
Turbidity	Field Probe	0.2 NTU	N/A	N/A	none
Turbidity <sup>1</sup>	EPA 180.1	0.01 NTU	48 hours <sup>2</sup>	500 ml plastic	none
Nitrite Nitrogen	EPA 354.1	0.001 mg/l	48 hours <sup>2</sup>	2 - 500 ml plastic	4°C - H <sub>2</sub> SO <sub>4</sub>
Nitrate + Nitrite	EPA 353.2	0.010 mg/l	28 days		
Ammonia Nitrogen	EPA 350.1	0.005 mg/l	28 days		
Total Kheldal Nitrogen	EPA 351.3	0.025 mg/l	28 days		
Total Phosphorus	EPA 365.2	0.005 mg/l	28 days		
Chlorophyll-a	SM 1002 G	0.03 mg/m <sup>3</sup>	3 months	Whatman (0.7 micron) GF/F filter	frozen, manganese sulfate
Zinc	EPA 200.7	20 µg/l	6 months	500 ml plastic	4°C - HNO <sub>3</sub> to a pH of ≤ 2
Copper <sup>3</sup>	EPA 220.2	2 µg/l			

**Notes:**

<sup>1</sup> Turbidity samples sent to lab from selected stations only to verify probe readings. Stations selected at discretion of field team leader.

<sup>2</sup> Holding times for turbidity and nitrite-nitrogen are unavoidably exceeded because of logistics involved in shipping from American Samoa. The laboratory (AMTEST) agreed to test for these constituents immediately upon receipt of the samples.

<sup>3</sup> Analytical Resources, Inc. tested for copper using method 200.7, following extraction by coprecipitation to achieve the required detection limit.



**Figure 2-1  
Station Locations**



### **3. DATA SUMMARY**

It is convenient to categorize the parameters measured in the field and laboratory during this study into three classes: physical and hydrographic parameters that generally describe the water column structure; nutrient and biological parameters that relate more to the health of the harbor; and trace metals. Physical and hydrographic parameters include temperature, salinity, density, DO, pH, turbidity, and Secchi depth, which is used as an indicator of light penetration. Nutrient and biological parameters include the various types of nitrogen, phosphorous, and chlorophyll-a. Zinc and copper were the trace metals of specific interest for this investigation. The results of the November 1996 sampling episode for each of these classes of parameters are presented below.

#### **3.1 PHYSICAL HYDROGRAPHIC PARAMETERS.**

The physical and hydrographic parameters measured in the field during the November 1996 harbor monitoring included (in addition to station location and total water depth): temperature, conductivity, dissolved oxygen, pH, turbidity, and light penetration by means of Secchi depth. Temperature, conductivity, and turbidity were measured as continuous vertical profiles. At selected stations turbidity was also measured in the laboratory using the water samples collected as described above. Salinity and density profiles were calculated from the CTD data using the SeaBird software.

Tables 3-1.a through 3-1.d summarize the vertical water column profile data collected with the CTD profiling instrument. The data plots of these hydrographic variables are provided in Appendix III. The Secchi depth measurements are presented in Table 2-1 above. The laboratory analyses for turbidity are given in Table 3-2. The measured values for DO and pH for each station and depth are given in Table 3-3. A brief description of each of the hydrographic parameters of interest parameters is given below.

##### **3.1.1 Temperature**

Temperature summaries are given in Table 3-1.a. There was very little variation in temperature throughout the harbor with measured values between 28 and 29.6 °C. Inner harbor temperatures were, at most, a few tenths of a degree warmer than the open ocean. The vertical temperature variations were no more than one degree. There was no identifiable effect of the discharge observable in or around the boundary of the mixing zone.

##### **3.1.2 Salinity**

Salinity summaries are provided in Table 3-1.b. As in the case of temperature, there was little or no variability longitudinally. In general there is little stratification with vertical variations typically less than 1 ppt. There is no discernible influence from the JCO discharge.

### 3.1.3 Density

Density (Table 3-1.c), in terms of  $\sigma_t$ , is summarized in Table 3-1.c. The water column is very well mixed with little indication of a strong density gradients. Vertical variations between surface and bottom were typically seen to be about 0.5 sigma-t units (1 unit is equivalent to  $0.001 \text{ g/cm}^3$ ), at the harbor mouth, less than 1 unit in the outer harbor, and up to 1 unit in the inner harbor. There is little longitudinal variation and no discernible influence from the JCO discharge.

### 3.1.4 Turbidity

Turbidity was measured throughout the water column using a SeaPoint optical sensor mounted on the SeaBird CTD. The turbidity sensor was set for the highest resolution and lowest range and threshold possible. Even at these settings, the minimum reading of the instrument was approximately 0.13 NTU and the resolution was 0.01 NTU. That means any value lower than 0.13, even a value of zero, was recorded as 0.13 NTU. Conversations with the manufacturers of both the turbidity meter and the CTD on which it was mounted indicate the a portion of the 0.13 NTU lowest reading is an instrument offset and can be subtracted from the actual reading. However, this value is not easily determined and appropriate tests were not done to define this value in the field. Therefore, the data including the small offset is presented in this report. It is recognized that all values are reported slightly higher than they should be and the instrument detection limit is lower than 0.13 NTU.

The data from the turbidity profiles is summarized for each station in Table 3-1.d. A higher turbidity layer was often observed near bottom. The average values throughout the water column are low, generally less than 1 NTU. The ASWQS for turbidity is 0.75 NTU (median value). The median value for the continuous profiles at each station was not calculated but can be approximated from the plots in Appendix III. Compliance with the ASWQS is achieved based on the profile data. Because of the instrument characteristics, the potential problem of a undefined offset was recognized in the field and turbidity analysis was requested on selected samples in and around the mixing zone. Samples from the all stations within the mixing zone and on the mixing zone boundary were sampled for turbidity analysis. The data are given in Table 3-2 and indicate compliance with ASWQS.

### 3.1.5 Dissolved Oxygen

There is both vertical and longitudinal spatial variability and temporal variability of DO indicated in the data provided in Table 3-3, as was expected. There is, however, no indication of a reduction of DO in the mixing zone. There is sufficient temporal variability, depending on time of day the measurement was taken, to mask any overall trends in longitudinal spatial variation. This is consistent with the higher chlorophyll-a values than previously measured in March of 1996, and March 1995. There is a distinct vertical trend with higher values usually found near the surface. A subsurface depression is seen at some of the stations.

The measured DO was above the numerical American Samoa water quality standard (ASWQS) on a water column average basis at every station and on a point-by point basis at over 85 percent of the points sampled. [The ASWQS is that DO shall be "*Not less than 70 percent of saturation or less than 5.0 mg/l. If the natural level of dissolved oxygen is less than 5.0 mg/l, the natural level will become the standard.*"] The data available is insufficient to determine if those observed values below 5.0 are "natural" or result from the effluent discharge. However, the pattern observed indicates high productivity may be a primary factor resulting in depressed DO levels at depth. The ASWQS specifies an (undefined) average value of 5 mg/l as that needed for compliance. It is noted that any type of reasonable average for the data recovered will result in compliance.

### **3.1.6 pH Measurements**

Table 3-3 summarizes the pH readings obtained during the study. There are small differences observed along the harbor axis, but no distinct trends. Surface values are slightly lower than those at depth. No effect of the discharge can be observed.

Measured pH values appear to meet the ASWQS numerical standard at all locations. [The ASWQS is the "*The pH range shall be 6.5 to 8.6 and be within 0.2 pH unit of that which would occur naturally.*"] The natural value for marine waters is generally considered to be in the range of 7.5 to 8.4. For near surface waters (water in equilibrium with atmospheric CO<sub>2</sub>), pH is typically about 8.1 to 8.2. Variability in coastal waters will be more extreme and freshwater inflows will tend to depress the natural values.

During the study, it was observed that the pH values being recorded by the profiling instrument appeared consistently lower than expected. Calibration of the instrument in the field was considered but determined to be not feasible. Therefore, pH of surface samples was measured with a calibrated pH meter and compared to the readings at the surface from the profiling instrument and a correction was developed and applied to the profile data. The details of this process are provided in Appendix IV.

### **3.1.7 Secchi Depth**

Secchi depths are presented in Table 2-1 above. The values recorded show a trend, increasing from the inner harbor to the outer harbor as would be expected. This trend is somewhat confused by the differences in time of day, and thus sun angle and diurnal variations in water clarity. In addition, it must be noted, the times of data collection were almost entirely during complete or nearly complete overcast sky conditions and thus Secchi depths will be substantially understated compared to those collected under standard clear sky conditions. The Secchi depths observed in the inner harbor range from 15 to 20 feet. The Secchi depth was 15 feet at Station 13 which is the inner most station, in a total water depth of about 29 feet.

The ASWQS is in terms of light penetration, which cannot be directly converted from Secchi or turbidity readings. However, some estimates can be made with light penetration being estimated by Secchi depth using the following approximation:

$$\chi = \kappa \cdot D^{-1}$$

where

$\chi$  = extinction coefficient for visible light

$\kappa$  = a constant

and

D = Secchi depth in meters for a 30 cm Secchi disk.

The constant  $\kappa$  is not easily determined but is often taken as 1.7 based on data from the English Channel (Sverdrup, 1942). Using the above approximation, the depth of light penetration of 1 percent corresponds to a Secchi depth of 24 feet. Such a calculation corresponds to Secchi readings taken at high sun angles and in full sun light. As pointed out above, this was not possible during times of data collection in November 1996. The corresponding depth under conditions during measurements at this time is likely less than half that calculated above, based on a review of previous data.

The ASWQS state that light penetration of 1 percent of the incident light should penetrate to a depth of 65 feet 50 percent of the time. As calculated above this corresponds to Secchi depth of approximately 24 feet (under appropriate conditions). The data can not be directly used to evaluate compliance in this case, however expedience and judgment would indicate that ASWQS for light penetration are being satisfied throughout the harbor.

### 3.2 NUTRIENT AND BIOLOGICAL PARAMETERS

Parameters to evaluate potential impacts of biological productivity included nutrients and chlorophyll-a. Nutrients included total phosphorus, total Kheldal nitrogen (TKN), ammonia nitrogen, nitrate plus nitrite, and nitrite nitrogen. ASWQS apply to total nitrogen (TN) which was calculated by adding the nitrogen components, noting that ammonia is included in TKN. Table 2-2 above indicates the nutrient constituents measured and the methods used in the laboratory. Samples were prepared for chlorophyll-a analysis by filtering 2 liters of water through a filter (see Table 2.2) using a vacuum pump apparatus. The filters were treated with manganese sulfate as a preservative, frozen, and then sent to the laboratory for analysis.

The laboratory used for the analyses was AMTEST, located in Redmond, WA. Samples were stored on ice in American Samoa and shipped on ice via DHL to the laboratory. Laboratory chain of custody forms and results are provided in Appendices IV and V, respectively. Each of the nutrient and parameters are discussed below based on the data summarized in Table 3-4.

### **3.2.1 Total Nitrogen**

The numerical standard (median value) for total nitrogen (TN) is 200 µg/l. Of the 100 measurements 1 was above this value. A TN of approximately 266 was recorded at Station 11A in the inner harbor at a depth of 30 feet. The next highest value was 178 at station 8A at a depth of 60 feet, which is inside the mixing zone. The ASWQS for TN is met throughout the harbor at the time of sampling.

### **3.2.2 Total Phosphorus**

The numerical standard for total phosphorus (median value) is 30 µg/l. As shown in Table 3-4, a total 4 of the 100 measurements were above this value. At Station 9 there were two measurements reported at 31 µg/l at depths of 30 and 60 feet (a concentration of 30 µg/l was reported at 90 feet). The median value at this station was 30 µg/l. At station 8A TP concentrations of 62 and 65 µg/l were reported at 30 and 60 feet, respectively. Station 8A is within the mixing zone and the median value at this station was between 17 and 23 µg/l. The ASWQS for TP is met throughout the harbor at the time of sampling.

### **3.2.3 Chlorophyll-a**

The numerical standard (median) for chlorophyll-a is 1 µg/l. Fourteen (14) of the 20 stations exhibited chlorophyll-a values higher than 1.0 µg/l. In every case the higher values were in the upper portion of the water column, typically at the near surface and 30 foot depths (see Table 3-4). At 9 of the 14 stations the median was at or below the ASWQS of 1.0 µg/l. Of the remaining stations two (12 and 13) are in the inner harbor which typically has higher levels, only one is on the mixing zone boundary (17), and two are in the outer harbor (6A and 7). The median value for the harbor was less than 1.0 µg/l and the median value for each station was below 1.0 µg/l except as noted above.

It appears that many of the elevated values could be attributable to runoff through Pago Pago Creek, and other streams around the harbor. Examination of the other water column constituents provides no evidence that the elevated values of chlorophyll-a are attributable to the JCO discharge. Overall, regardless of the higher values in certain locations, the ASWQS appear to be met throughout the harbor with the possible exception of the far inner harbor, which is attributable to causes other than the JCO discharge as mentioned above, and a small portion of the outer harbor, not within the mixing zone.

## **3.3 Zinc and Copper Concentrations**

Zinc and copper were measured at specified stations and depths. Samples were collected and preserved as described above and in the SAP/SOP (Appendix II). Table 3-5 summarizes the results of the metals analyses. The chain of custody forms and laboratory results are provided in Appendices IV and VI, respectively. All analyses resulted in reported values less than detection limits. The reason for conducting these analyses is to provide receiving water data

for the assessment of a mixing zone for these two metals. The data for both zinc and copper were adequate for this purpose with values of  $<20 \mu\text{g/l}$  and  $< 2 \mu\text{g/l}$  as requested and well below the water quality criteria.

<b>Table 3-1.a</b> <b>Summary of Temperature Measurements (°C)</b> <b>from Continuous Vertical Profiles</b> <b>Pago Pago Harbor Water Quality Modeling</b> <b>23 November 1996</b>				
<b>Station</b>	<b>Maximum</b>	<b>Minimum</b>	<b>Average</b>	<b>Standard Deviation</b>
<b>Transition Zone</b>				
5	28.63	27.97	28.21	0.18
5A	28.88	28.18	28.30	0.16
<b>Outer Harbor</b>				
6	29.06	27.87	28.19	0.26
6A	29.48	28.21	28.39	0.22
7	29.04	28.03	28.31	0.22
<b>Mixing Zone - Interior</b>				
8	28.55	28.03	28.31	0.15
8A	28.52	28.00	28.25	0.16
14	28.53	28.00	28.28	0.16
<b>Mixing Zone - Edge</b>				
15	28.49	28.17	28.32	0.09
16	29.19	27.99	28.26	0.23
17	28.68	28.13	28.36	0.12
18	28.62	28.01	28.24	0.16
<b>Middle Harbor</b>				
9	29.26	28.14	28.38	0.23
9A	29.34	28.24	28.42	0.23
10	29.31	28.01	28.33	0.30
10A	28.95	28.19	28.36	0.20
<b>Inner Harbor</b>				
11	29.05	28.02	28.31	0.19
11A	29.04	28.05	28.36	0.24
12	29.10	28.07	28.31	0.23
13	29.56	28.39	28.65	0.32

**Table 3-1.b**  
**Summary of Salinity Measurements (PSU)**  
**from Continuous Vertical Profiles**  
**Pago Pago Harbor Water Quality Modeling**  
**23 November 1996**

Station	Maximum	Minimum	Average	Standard Deviation
<b>Transition Zone</b>				
5	35.70	35.36	35.63	0.05
5A	35.66	35.20	35.60	0.08
<b>Outer Harbor</b>				
6	35.73	35.02	35.62	0.13
6A	35.64	35.26	35.60	0.08
7	35.68	34.52	35.52	0.23
<b>Mixing Zone - Interior</b>				
8	35.67	34.83	35.56	0.14
8A	35.66	34.75	35.59	0.11
14	35.66	34.80	35.58	0.12
<b>Mixing Zone - Edge</b>				
15	35.64	34.35	35.56	0.21
16	35.73	34.99	35.61	0.12
17	35.64	35.25	35.57	0.08
18	35.67	34.65	35.57	0.17
<b>Middle Harbor</b>				
9	35.62	34.69	35.53	0.17
9A	35.64	34.94	35.54	0.15
10	35.68	35.03	35.58	0.14
10A	35.64	35.10	35.55	0.11
<b>Inner Harbor</b>				
11	35.65	34.67	35.56	0.13
11A	35.66	34.71	35.50	0.21
12	35.60	34.66	35.51	0.13
13	35.53	34.42	35.35	0.23



**Table 3-1.c**  
**Summary of Sigma-t Measurements**  
**from Continuous Vertical Profiles**  
**Pago Pago Harbor Water Quality Modeling**  
**23 November 1996**

Station	Maximum	Minimum	Average	Standard Deviation
<b>Transition Zone</b>				
5	22.93	22.46	22.80	0.10
5A	22.84	22.26	22.75	0.11
<b>Outer Harbor</b>				
6	22.97	22.07	22.80	0.18
6A	22.81	22.14	22.72	0.13
7	22.90	21.72	22.69	0.24
<b>Mixing Zone - Interior</b>				
8	22.87	22.10	22.72	0.14
8A	22.89	22.05	22.76	0.12
14	22.90	22.09	22.74	0.13
<b>Mixing Zone - Edge</b>				
15	22.82	21.77	22.71	0.18
16	22.94	21.99	22.77	0.17
17	22.83	22.37	22.71	0.09
18	22.89	21.93	22.75	0.17
<b>Middle Harbor</b>				
9	22.80	21.74	22.67	0.20
9A	22.80	21.91	22.66	0.19
10	22.91	22.00	22.72	0.21
10A	22.82	22.16	22.69	0.15
<b>Inner Harbor</b>				
11	22.88	21.80	22.72	0.16
11A	22.84	21.83	22.65	0.23
12	22.81	21.83	22.65	0.23
13	22.67	21.44	22.45	0.28

**Table 3-1.d**  
**Summary of Turbidity Measurements (NTU)**  
**from Continuous Vertical Profiles**  
**Pago Pago Harbor Water Quality Modeling**  
**23 November 1996**

Station	Maximum	Minimum	Average	Standard Deviation
<b>Transition Zone</b>				
5	1.07	0.12	0.37	0.20
5A	0.65	0.13	0.22	0.11
<b>Outer Harbor</b>				
6	0.93	0.15	0.42	0.20
6A	1.42	0.27	0.51	0.24
7	1.72	0.39	0.75	0.35
<b>Mixing Zone - Interior</b>				
8	4.74	0.18	0.73	0.53
8A	14.04	0.38	1.75	2.74
14	3.49	0.23	0.96	0.77
<b>Mixing Zone - Edge</b>				
15	6.29	0.38	1.03	0.55
16	3.40	0.16	0.64	0.55
17	2.08	0.42	0.84	0.27
18	5.17	0.20	0.94	0.72
<b>Middle Harbor</b>				
9	1.60	0.38	0.81	0.31
9A	2.80	0.34	0.78	0.31
10	6.23	0.31	0.64	0.48
10A	1.73	0.32	0.50	0.15
<b>Inner Harbor</b>				
11	2.74	0.25	0.83	0.52
11A	3.17	0.43	0.99	0.65
12	2.42	0.64	1.21	0.47
13	9.48	0.92	1.86	1.07

**Table 3-2**  
**Results of Laboratory Analyses of Turbidity for Selected Stations**  
**Pago Pago Harbor Water Quality Monitoring**  
**November 1996**

Depth (feet) <sup>1</sup>	Turbidity at Station Depths Indicated (NTU)							
	S	30	60	90	120	B	Average	Median
Stations								
Mixing Zone Interior								
8	0.10	0.09	0.05	0.01	<0.01	<0.01	0.05	0.01 - 0.05
8A	0.11	0.24	0.27	0.03	<0.01	0.07	0.12	0.07 - 0.11
14	0.14	0.15	0.07	0.04	0.05	0.11	0.09	0.07 - 0.11
ZOM Boundary								
15 <sup>2</sup>	0.20	0.09	0.03	-	-	0.06	0.10	0.06 - 0.09
16	0.18	0.11	0.12	0.08	0.16	0.20	0.14	0.12 - 0.16
17 <sup>3</sup>	0.19	0.22	-	-	-	0.21	0.21	0.21
18	0.13	0.43	0.14	0.08	0.08	0.13	0.17	0.13 - 0.14

Notes:

<sup>1</sup> S = Near Surface (within 1 meter of the surface); B= Near Bottom (within 1 meter of the bottom)

<sup>2</sup> Station 15 sampled at only four depths as shown

<sup>3</sup> Stations 17 sampled at only three depths as shown.

**Table 3-3**  
**Dissolved Oxygen and pH measurements**  
**Pago Pago Harbor Water Quality Monitoring - November 1996**

Station	Depth	DO (mg/l)	pH (SU) <sup>1</sup>	Station	Depth	DO (mg/l)	pH (SU) <sup>1</sup>
5	SURF	5.5	8.36	10A	SURF	5.8	8.35
	30	5.6	8.28		30	5.3	8.35
	60	5.7	8.34		60	5.3	8.35
	90	5.8	8.30		90	5.2	8.35
	120	5.9	8.29		BOTM	5.2	8.35
	BOTM	5.9	8.28				
5A	SURF	5.6	8.26	11	SURF	7.9	8.37
	30	5.6	8.36		30	7.4	8.36
	60	5.6	8.33		60	7.0	8.35
	90	5.4	8.32		90	7.2	8.36
	120	5.5	8.29		120	6.8	8.35
	BOTM	5.4	8.23		BOTM	6.4	8.35
6	SURF	5.0	8.38	11A	SURF	7.7	8.37
	30	5.1	8.41		30	7.4	8.35
	60	5.0	8.42		60	6.8	8.34
	90	4.9	8.40		90	7.0	8.34
	120	4.8	8.45		BOTM	6.5	8.34
	BOTM	4.7	8.45				
6A	SURF	5.1	8.43	12	SURF	7.7	8.35
	30	5.1	8.38		30	6.8	8.32
	60	5.1	8.38		BOTM	6.6	8.32
	BOTM	5.0	8.41				
7	SURF	5.1	8.36	13	SURF	7.9	8.35
	30	4.6	8.34		15	7.1	8.30
	60	5.1	8.32		BOTM	6.4	8.21
	90	5.2	8.28				
	BOTM	5.2	8.38				
8	SURF	5.4	8.42	14	SURF	5.4	8.44
	30	5.1	8.44		30	5.1	8.43
	60	5.0	8.36		60	4.6	8.40
	90	4.9	8.37		90	4.8	8.42
	120	4.9	8.41		120	5.0	8.39
	BOTM	5.1	8.39		BOTM	4.6	8.35
8A	SURF	5.4	8.39	15	SURF	5.3	8.22/8.07
	30	5.1	8.37		30	5.1	8.27/8.29
	60	5.0	8.32		60	5.0	8.29/8.28
	90	5.1	8.37		BOTM	4.8	8.28/8.09
	120	4.9	8.36				
	BOTM	4.8	8.35				
9	SURF	6.1	8.33	16	SURF	5.6	8.34/8.38
	30	4.9	8.30		30	5.3	8.28/8.41
	60	5.0	8.28		60	5.2	8.27/8.41
	90	4.6	8.28		90	5.3	8.30/8.20
	BOTM	5.1	8.30		120	5.5	8.31/8.43
					BOTM	4.6	8.30/8.21
9A	SURF	6.0	8.30	17	SURF	4.9	8.43
	30	6.5	8.29		30	5.0	8.48
	60	6.0	8.28		BOTM	4.3	8.36
	90	5.9	8.26				
	BOTM	6.2	8.18				
10	SURF	6.0	8.30	18	SURF	5.3	8.31
	30	5.9	8.32		30	5.1	8.35
	60	5.9	8.32		60	5.1	8.34
	90	5.8	8.34		90	5.1	8.37
	120	5.4	8.34		120	5.1	8.36
	BOTM	5.4	8.35		BOTM	4.9	8.34

<sup>1</sup> pH values shown in ***bold italic*** were measured in chlorophyll-a samples during filtering, others were measured in the field as samples were collected.

**Table 3-4**  
**Nutrients and Chlorophyll-a Measurements**  
**Pago Pago Harbor Water Quality Monitoring**  
**November 1996**

Station	Depth	Chlorophyll-a (mg/m <sup>3</sup> )	Ammonia Nitrogen (mg/l)	TKN (mg/l)	Nitrate + Nitrite (mg/l)	Nitrite Nitrogen (mg/l)	Total Phosphorus (mg/l)
5	SURF	0.25	<0.005	0.028	<0.01	<0.001	0.009
5	30	0.22	<0.005	<0.025	<0.01	<0.001	0.009
5	60	0.48	<0.005	0.049	<0.01	<0.001	0.014
5	90	0.59	<0.005	0.066	<0.01	<0.001	<0.005
5	120	0.12	<0.005	0.092	<0.01	0.002	0.011
5	BOTM	0.12	<0.005	0.028	<0.01	0.009	0.013
5A	SURF	0.34	<0.005	0.071	<0.01	<0.001	0.005
5A	30	0.59	<0.005	0.060	<0.01	<0.001	0.013
5A	60	0.71	<0.005	0.093	<0.01	<0.001	0.012
5A	90	0.49	<0.005	0.043	<0.01	<0.001	0.011
5A	120	0.47	<0.005	<0.025	<0.01	<0.001	0.009
5A	BOTM	0.36	<0.005	<0.025	<0.01	0.009	0.010
6	SURF	1.8	<0.005	0.063	<0.01	0.001	0.008
6	30	2.0	<0.005	0.097	<0.01	0.001	0.016
6	60	0.96	<0.005	0.029	<0.01	0.002	0.009
6	90	0.57	<0.005	<0.025	<0.01	0.005	0.014
6	120	0.34	<0.005	0.039	<0.01	0.010	0.007
6	BOTM	0.48	<0.005	0.047	<0.01	0.009	0.010
6A	SURF	1.3	<0.005	0.039	<0.01	<0.001	0.009
6A	30	1.6	<0.005	0.10	<0.01	<0.001	0.009
6A	60	1.5	<0.005	0.068	<0.01	<0.001	0.012
6A	BOTM	0.78	<0.005	<0.025	<0.01	<0.001	0.009
7	SURF	1.6	<0.005	<0.025	<0.01	<0.001	0.019
7	30	1.3	0.005	0.035	0.012	0.012	0.020
7	60	1.1	<0.005	0.028	<0.01	0.005	0.016
7	90	1.3	<0.005	0.12	<0.01	0.003	0.016
7	BOTM	0.61	<0.005	0.051	<0.01	0.003	0.024
8	SURF	2.0	<0.005	<0.025	<0.01	<0.001	0.014
8	30	2.7	<0.005	<0.025	<0.01	0.001	<0.005
8	60	0.85	0.006	0.040	<0.01	0.011	0.027
8	90	0.59	<0.005	<0.025	<0.01	0.003	<0.005
8	120	0.36	<0.005	<0.025	<0.01	0.003	0.022
8	BOTM	0.59	<0.005	<0.025	<0.01	0.003	<0.005
8A	SURF	1.2	<0.005	0.031	<0.01	<0.001	0.023
8A	30	1.9	0.10	0.15	<0.01	0.006	0.062
8A	60	0.96	0.10	0.17	<0.01	0.008	0.065
8A	90	0.60	<0.005	<0.025	<0.01	0.003	0.017
8A	120	0.35	<0.005	<0.025	<0.01	0.004	0.016
8A	BOTM	0.24	<0.005	<0.025	0.014	0.022	0.013
9	SURF	0.35	<0.005	<0.025	<0.01	0.017	0.022
9	30	0.53	0.009	0.047	<0.01	<0.001	0.031
9	60	0.37	0.01	<0.025	0.022	0.030	0.031
9	90	0.36	0.008	0.056	0.031	0.029	0.030
9	BOTM	0.34	<0.005	<0.025	0.013	0.016	0.024
9A	SURF	0.82	<0.005	<0.025	<0.01	0.001	0.018
9A	30	0.80	<0.005	<0.025	<0.01	0.018	0.022
9A	60	0.37	<0.005	<0.025	<0.01	0.027	0.026
9A	90	0.34	<0.005	<0.025	0.016	0.005	0.019
9A	BOTM	0.31	<0.005	<0.025	<0.01	0.002	0.019

Table 3-4 - continued

Station	Depth	Chlorophyll-a (mg/m <sup>3</sup> )	Ammonia Nitrogen (mg/l)	TKN (mg/l)	Nitrate + Nitrite (mg/l)	Nitrite Nitrogen (mg/l)	Total Phosphorus (mg/l)
10	SURF	0.74	<0.005	<0.025	<0.01	<0.001	0.013
10	30	0.69	<0.005	0.030	<0.01	0.007	0.019
10	60	0.47	<0.005	0.062	<0.01	0.009	0.012
10	90	0.48	<0.005	0.030	<0.01	0.004	0.012
10	120	0.59	<0.005	<0.025	<0.01	0.014	0.014
10	BOTM	0.49	<0.005	<0.025	<0.01	<0.001	0.014
10A	SURF	0.36	<0.005	<0.025	<0.01	0.002	0.014
10A	30	0.69	<0.005	<0.025	<0.01	0.007	0.018
10A	60	0.47	<0.005	<0.025	<0.01	0.003	0.011
10A	90	0.61	<0.005	<0.025	<0.01	0.007	0.012
10A	BOTM	0.50	<0.005	<0.025	<0.01	0.007	0.014
11	SURF	1.8	<0.005	<0.025	<0.01	0.002	0.014
11	30	1.1	<0.005	<0.025	<0.01	0.006	0.011
11	60	0.98	<0.005	<0.025	0.011	0.021	0.012
11	90	0.43	<0.005	0.029	<0.01	0.008	<0.005
11	120	0.29	<0.005	<0.025	<0.01	0.024	<0.005
11	BOTM	0.41	<0.005	<0.025	0.014	0.026	0.019
11A	SURF	1.7	<0.005	<0.025	<0.01	0.002	<0.005
11A	30	1.4	<0.005	0.26	<0.01	0.006	<0.005
11A	60	0.60	<0.005	0.13	0.019	0.023	0.011
11A	90	0.61	<0.005	0.049	<0.01	0.011	0.011
11A	BOTM	0.24	<0.005	0.037	0.018	0.027	0.016
12	SURF	1.9	<0.005	0.050	<0.01	0.003	0.010
12	30	1.0	<0.005	0.034	0.011	0.013	0.018
12	BOTM	0.35	<0.005	0.056	0.027	0.033	0.010
13	SURF	3.7	<0.005	0.070	0.024	0.002	0.025
13	15	1.4	<0.005	<0.025	<0.01	0.005	0.014
13	BOTM	1.2	<0.005	<0.025	<0.01	0.013	0.016
14	SURF	1.8	<0.005	<0.025	<0.01	0.002	0.009
14	30	2.6	<0.005	<0.025	<0.01	0.004	<0.005
14	60	0.48	0.016	0.042	0.011	0.013	0.017
14	90	0.60	<0.005	<0.025	<0.01	0.006	<0.005
14	120	0.12	<0.005	<0.025	<0.01	0.013	<0.005
14	BOTM	0.12	<0.005	0.038	<0.01	0.021	0.021
15	SURF	1.8	<0.005	<0.025	<0.01	0.002	0.016
15	30	1.2	<0.005	<0.025	<0.01	0.009	0.018
15	60	0.84	<0.005	<0.025	<0.01	0.013	0.014
15	BOTM	0.49	0.015	0.031	0.029	0.028	0.020
16	SURF	1.4	<0.005	<0.025	<0.01	0.002	0.017
16	30	1.6	<0.005	<0.025	<0.01	0.003	<0.005
16	60	0.24	<0.005	0.033	<0.01	0.004	0.009
16	90	0.48	<0.005	<0.025	<0.01	0.001	<0.005
16	120	1.2	<0.005	<0.025	<0.01	<0.001	0.011
16	BOTM	0.12	<0.005	<0.025	0.017	0.028	0.018
17	SURF	1.1	<0.005	<0.025	<0.01	<0.001	0.013
17	30	2.0	<0.005	<0.025	<0.01	<0.001	0.018
17	BOTM	0.74	0.044	0.12	<0.01	0.012	0.048
18	SURF	1.7	<0.005	<0.025	<0.01	<0.001	0.010
18	30	1.5	0.009	0.049	<0.01	0.010	0.020
18	60	1.3	<0.005	<0.025	<0.01	0.006	0.019
18	90	0.73	<0.005	<0.025	<0.01	0.004	0.018
18	120	0.48	<0.005	<0.025	<0.01	0.010	0.026
18	BOTM	0.24	<0.005	<0.025	0.012	0.022	0.015

**Table 3-5**  
**Zinc and Copper Analysis Results**  
**Pago Pago Harbor Water Quality Monitoring**  
**November 1996**

Station	Depth	Zinc Concentration (µg/l)	Copper Concentration (µg/l)
<b>Transition Zone</b>			
5	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
5A	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
<b>Inner Harbor</b>			
11	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
13	Near Surface	<20	<2
	Near Bottom	<20	<2
<b>ZOM Boundary</b>			
15	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
16	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2
18	30	<20	<2
	120	<20	<2
	Near Bottom	<20	<2

## 4. CONCLUSIONS AND RECOMMENDATIONS

The second semiannual Receiving Water Quality Monitoring study was successfully completed with only minor deviations from the SAP/SOP. The data indicate compliance with ASWQS throughout the harbor. The water quality standards are based on median values of many constituent concentrations, and the standards were fully achieved on this basis. The numerical criteria, on which the standards are based, are occasionally exceeded at individual stations (although this does not necessarily mean water quality standards are violated). However, in no instance outside the mixing zone, can the individual excursions above the criteria be attributed to the JCO discharge. The canneries are in compliance with the applicable conditions of the NPDES permits.

Other than specific points described in the report, no general recommendations are made for conducting future sampling episodes of water quality monitoring. Summarizing specific points for detailed field and laboratory work the following recommendation is made, and will be followed in the future:

The turbidity sensor should be more rigorously tested, if possible to determining the actual instrument offset and resolution for reasons described in Section 3. Until we are confident of the performance of the sensor, supplementary samples should continue to be designated for turbidity testing in the laboratory. Locations should be at the mixing zone boundary (Stations 15,16,17, and 18) and background (Stations 5 and 5A). Concurrent with the "dock side" verification testing for other profiling instruments, the readings from the turbidity sensor should be examined before and after the sampling and profiling.



## 5. REFERENCES

- CH2M HILL, 1991. Engineering and Environmental Feasibility Evaluation of Waste Disposal Alternatives. Prepared for StarKist Samoa, Final Report, March 1991.
- CH2M HILL and Glatzel and Associates, 1995. Results of March 1995 Harbor Water Quality Monitoring, Pago Pago American Samoa.
- CH2M HILL and **gdc**, 1997. Receiving Water Quality Monitoring Report: Pago Pago Harbor, American Samoa: March 1996 Sampling. 6 March 1996.
- D&A Instrument Company, 1991. Instruction manual: OBS-1 & 3 Suspended Solids & Turbidity Monitor. Port Townsend, WA Revised March 1991.
- Environmental Protection Agency, Region 10, 1992. Authorization to Discharge Under the National Pollution Discharge Elimination System; Permit No. AS0000019, Issued to StarKist Samoa, Inc., 24 September 1992.
- Environmental Protection Agency, Region 10, 1992. Authorization to Discharge Under the National Pollution Discharge Elimination System; Permit No. AS0000027, Issued to VCS Samoa packing Company, 24 September 1992.
- Environmental Protection Agency, Region 10, 1992. Modification of Receiving Water Quality Monitoring Requirements of NPDES Permit AS000019 for StarKist Samoa, Inc. and NPDES Permit AS0000027 for VCS Samoa Packing Company. November 8, 1995.
- Sea-Bird Electronics, Inc., 1993. CDT Data Acquisition Software: SEASOFT, Version 4.026. Bellevue, WA, May 1993.
- Sverdrup, H.U. et al., 1942. The Oceans. Prentice-hall, Englewood Cliffs NJ.

## **Appendix I**

### **USEPA Permit Modification for Receiving Water Quality Monitoring**



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION IX

75 Hawthorne Street  
San Francisco, CA 94105

NOV 08 1995

Norman Wei  
Corporate Environmental Manager  
StarKist Foods, Inc.  
1054 Ways Street  
Terminal Island, CA 90731

James L. Cox  
Director of Engineering  
and Environmental Affairs  
Van Camp Seafood Company, Inc.  
4510 Executive Drive, Suite 300  
San Diego, CA 92121-3029

Subject: Modification of Receiving Water Quality Monitoring  
Requirements of NPDES Permit AS0000019 for StarKist  
Samoa, Inc. and NPDES Permit AS0000027 for VCS Samoa  
Packing Company

Dear Mr. Wei and Mr. Cox:

The U.S. Environmental Protection Agency (EPA) Region IX is modifying the receiving water quality monitoring program for the above-referenced National Pollutant Discharge Elimination System (NPDES) Permits AS0000019 and AS0000027, as per 40 CFR 122, effective November 10, 1995. Based on review of the water quality data collected under this permit, it appears that the American Samoa water quality standards for constituents monitored under the NPDES permits for the canneries are generally being met throughout Pago Pago Harbor, except in the inner harbor and occasionally in the zone of mixing for the joint cannery outfall. It is surmised that the inner harbor exceedances may not be attributable to the canneries' discharge and the revised monitoring program will provide data to better define the causes for any noncompliance with water quality standards.

This modification to the receiving water quality monitoring program is considered a minor modification as the overall monitoring effort required is not being reduced. The purpose of the original monthly monitoring program was to assess the short-term effects of the canneries' discharge at the new outfall location. Over the past three years, sufficient data has been collected and reviewed for this purpose. The monitoring program is now being revised to assess the long-term effects of the discharge to the harbor. Changes are being made in monitoring frequency (from monthly to semi-annually to cover both oceanographic seasons), and in sampling types (from grab to continuous vertical profiles) for some parameters. Three new sampling stations are being re-

quired as well as monitoring for two additional parameters (zinc and copper) at certain stations.

Additional sampling for zinc and copper is being required to establish ambient background levels in the harbor which will be used to determine the applicability of establishing mixing zones for these constituents. Elevated zinc and copper effluent levels have been noted and significant reductions in source loadings would be very difficult, for reasons cited in the "Metals Source Identification Study for Samoa Packing", dated June 15, 1995.

The changes to the receiving water monitoring program are detailed in the attached pages. (Shaded text indicates additions to the permit. Lined out items are deletions.) These replace the corresponding pages in the permit and are hereby incorporated into and made a part of both Permits AS0000019 and AS0000027. In summary, the changes are as follows:

1. The frequency of sampling is reduced from monthly to semi-annually (corresponding with other sampling events required by the permit: effluent priority pollutant, toxicity and sediment monitoring);
2. The number of sampling stations is increased by three, from 17 to 20, and will be located as follows: on the western side of the middle harbor (American Samoa Power Authority Station B), outer harbor (new Station 6A), ... and transition zone (new Station 5A).
3. Continuous vertical profiles will be performed, rather than discrete samples, for temperature, salinity (conductivity), dissolved oxygen, pH, and turbidity.
4. Six, rather than three samples will be taken per station where possible, for nutrients and chlorophyll-a. Three samples will be taken at depths currently specified (near surface, 60 feet and near bottom), and three additional samples will be taken at 30, 90 and 120 feet. A minimum of three samples will be taken at each station (near surface, mid-depth and near bottom).
5. Suspended solids is removed from the suite of constituents to be analyzed.
6. Sampling for zinc and copper will be required and conducted at the same frequency as for the revised water quality monitoring program (approximately every six months). Sampling locations will be at the boundary of the existing mixing zone established for total nitrogen and total phosphorus, in the transition zone and in the inner harbor. Stations and depths to be sampled are as follows:

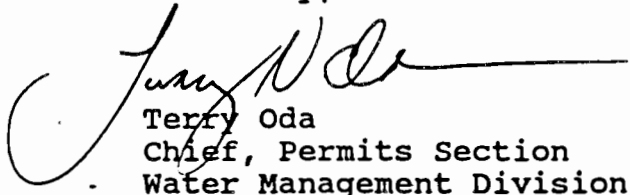
Stations	Depths
15, 16, 18, 5, 5A	30 ft., 120 ft., near bottom
11, 13	near surface, near bottom

The number of stations and samples may be adjusted based on the results of the first sampling episode.

7. A standard operating procedure and study plan for the revised water quality monitoring program will be developed and submitted within 30 days of the effective date of this revision for approval.

A copy of this letter and the revised pages of the permit should be attached to the current NPDES permit and kept at the respective facility's file for compliance purposes. Should you have any questions regarding this action, please call Pat Young, American Samoa Program Manager at (415) 744-1594 or Doug Liden of my staff at (415) 744-1920.

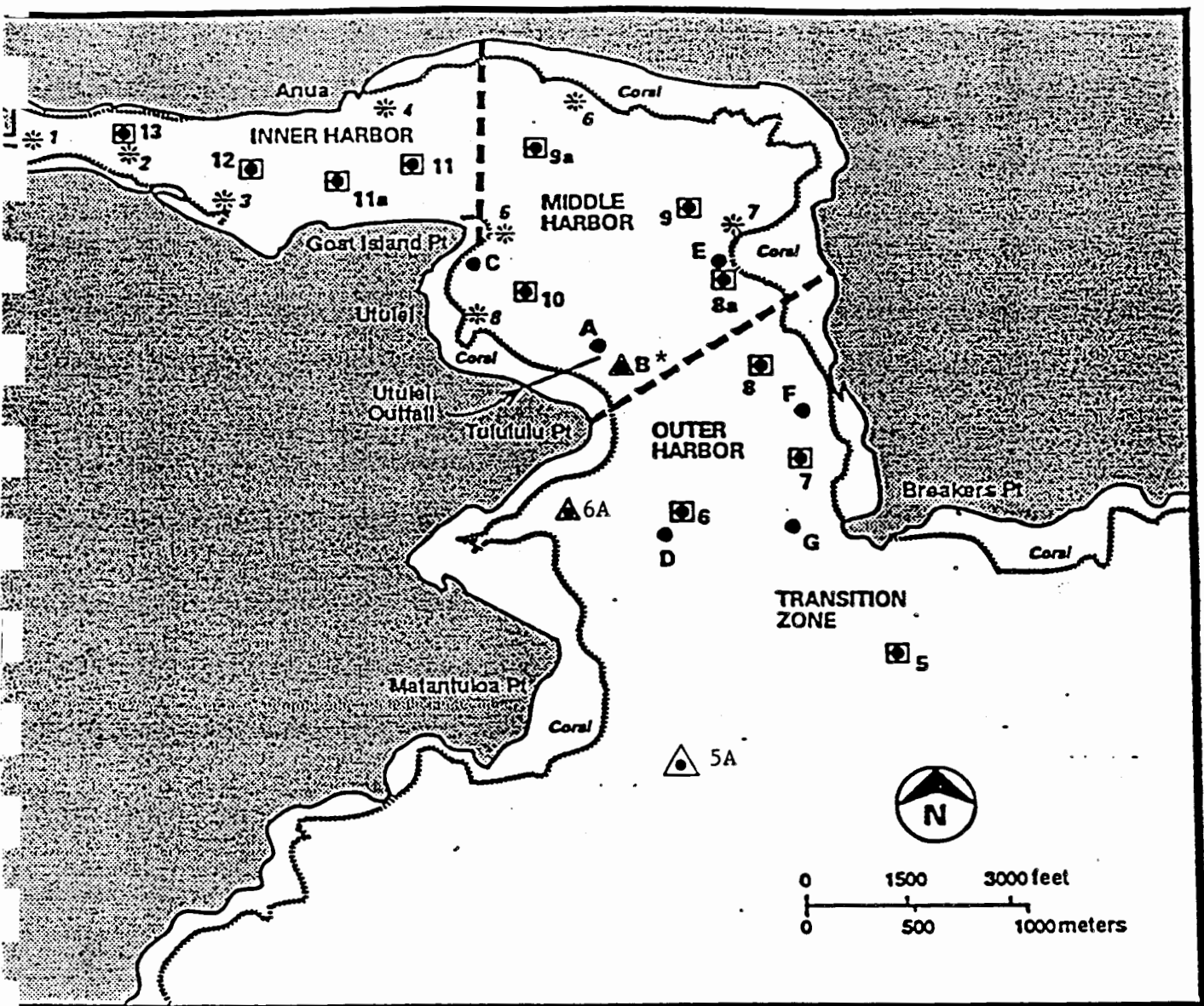
Sincerely,



Terry Oda  
Chief, Permits Section  
Water Management Division

#### Enclosures

cc: Steve Costa, CH2M HILL  
Togipa Tausaga/Sheila Wiegman, ASEPA  
Barry Mills, StarKist Samoa, Inc.  
William D. Perez, VCS Samoa Packing Company



#### LEGEND

- ☐ ASG Sampling Station
- Utulei WWTP Station
- \* CH2M HILL Field Measurement Station (1/19/91)

- ▲ New sampling station as per permit modifications, effective 11/10/95.
- \* ASPA Station B will be utilized and referred to as Station 10A.

REVISED FIGURE 2. LOCATION OF WATER QUALITY STATIONS IN PAGO PAGO HARBOR

Monitoring stations shall be designated and located as shown (also see Figures 1 and 2-revised):

Offshore Station	Vicinity	Location	Latitude		Coordinates	Longitude	
			West	Longitude		South	Latitude
5	Transition Zone		170° 39'	11.282°	-72W	14° 17'	53.488° -886
5A	Transition Zone	West	170° 40'	13.000°		14° 18'	29.000°
6	Outer harbor	Central	170° 40'	11.372°	-20W	14° 17'	21.172° -526
6A	Outer harbor	West	170° 40'	18.500°		14° 17'	31.000°
7	Outer harbor	East, S.	170° 39'	56.258°	-93W	14° 17'	22.359° -376
8	Outer harbor	East	170° 39'	53.960°	-40-07W	14° 17'	10.830° -176
8a	Middle harbor	East	170° 40'	5.529°	-13W	14° 16'	51.575° -886
9	Middle harbor	East	170° 40'	9.006°	-18W	14° 16'	39.561° -666
9a	Middle harbor	East	170° 40'	31.862°	-57W	14° 16'	34.908° -586
10	Middle harbor	West	170° 40'	39.508°	-76W	14° 16'	55.258° -876
10A	Middle harbor	West	170° 40'	20.000°		14° 17'	19.000°
11	Inner harbor	Center, E.	170° 40'	54.092°	-90W	14° 16'	34.195° -586
11a	Inner harbor	Center, E.	170° 41'	6.540°	-13W	14° 16'	38.573° -626
12	Inner harbor	Center	170° 41'	20.769°	-33W	14° 16'	36.564° -606
13	Inner harbor	Center, W.	170° 41'	42.819°	-71W	14° 16'	30.008° -506
14	Middle harbor	Diffuser	170° 40'	1.678°	-03W	14° 16'	58.934° -586
15	Middle harbor	ZOM Edge, N.	170° 40'	6.243°	-12W	14° 16'	45.692° -776
16	Middle harbor	ZOM Edge, W.	170° 40'	13.483°	-17W	14° 16'	57.273° -566
17	Middle harbor	ZOM Edge, E.	170° 40'	1.158°	-39-01W	14° 16'	54.398° -906
18	Outer harbor	ZOM Edge, S.	170° 39'	59.177°	-40-08W	14° 17'	8.962° -106

Note: Revised coordinates listed are locations of stations used and reported in CH2M Hill's July 7, 1995 Report, "Results of March 1995 Harbor Water Quality Monitoring Pago Pago Harbor, American Samoa", and are as read from GPS in field. (A correction factor based on readings at known locations may be required for exact station location.) Latitudes for Stations 14 and 16 originally listed in the permit were incorrect and are corrected here.

It is recommended that the stations be located using the sextant angle resection positioning method or a positioning system which affords an equivalent degree of accuracy and precision. Other means may be used if, in the judgment of ASEPA and EPA Region 9, they are of sufficient accuracy and precision to allow reoccupation of the stations within plus or minus six (6) meters.

The following shall constitute the Water Quality Monitoring Program as shown:

Parameter	Units	Stations	Sample Type	Sample Frequency
Temperature	°F	all	grab <del>continuous (1)</del>	monthly <del>semi-annual (2)</del>
pH	"	"	<del>continuous (1)</del>	" <del>semi-annual (2)</del>
Dissolved Oxygen	mg/l	"	<del>continuous (1)</del>	" <del>semi-annual (2)</del>
Suspended Solids	mg/l	"	"	"
Light Penetration	ft.	"	grab	" <del>semi-annual (2)</del>
Turbidity	NTU	"	<del>continuous (1)</del>	" <del>semi-annual (2)</del>
Salinity	ppt	"	<del>continuous (1)</del>	" <del>semi-annual (2)</del>
Chlorophyll a (3)	µg/l	"	grab	" <del>semi-annual (2)</del>
Total Nitrogen (3)	µg/l	"	"	" <del>semi-annual (2)</del>
Total Phosphorus (3)	µg/l	"	"	" <del>semi-annual (2)</del>
Total Ammonia (3)	µg/l	"	"	" <del>semi-annual (2)</del>
<del>Zinc</del>	<del>µg/l</del>	<del>(4)</del>	<del>"</del>	<del>semi-annual (2)</del>
<del>Copper</del>	<del>µg/l</del>	<del>(4)</del>	<del>"</del>	<del>semi-annual (2)</del>

~~(1) Continuous vertical profiles~~

~~(2) Sampling to occur approximately every 5 months to coincide with the two main oceanographic seasons~~

~~(3) Samples to be taken at the following depths where possible: near surface, 30, 60, 90 and 120 feet, and near bottom. Where water depth is less than 120 feet, a minimum of three samples shall be taken at each station (near surface, mid-depth and near bottom)~~

~~(4) The following stations shall be sampled at the noted depths:  
Stations 5, 5A, 15, 16 18: 30 feet, 120 feet, near bottom;  
Stations 11 and 13: near surface and near bottom.  
The number of stations and samples may be adjusted based on the results of the first sampling episode, upon approval by USEPA and ASEP.~~

~~Measurements should be taken at three depths for each location: 1 meter above the bottom, 1 meter below the surface, and at mid depth.~~

~~A study plan which includes standard operating procedures for receiving water quality measurements will be developed and submitted to ASEP and USEPA for approval within 30 days of the effective date of this revision.~~



Monitoring stations shall be designated and located as shown (also see Figures 1 and 2 ~~revised~~):

Offshore Station	Vicinity	Location	Latitude		Coordinates	Longitude	
			West	Longitude		South	Latitude
5	Transition Zone		170° 39'	14.282°	-12W	14° 17'	53.458° -886
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6A	Outer harbor	West	170° 40'	18.000°		14° 17'	13.000°
7	Outer harbor	East, S.	170° 39'	56.256°	-03W	14° 17'	22.339° -376
8	Outer harbor	East	170° 39'	53.960°	-07W	14° 17'	10.830° -176
8a	Middle harbor	East	170° 40'	5.529°	-13W	14° 16'	51.575° -886
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12	Inner harbor	Center	170° 41'	20.769°	-33W	14° 16'	26.564° -606
13	Inner harbor	Center, W.	170° 41'	42.849°	-71W	14° 16'	30.008° -606
14	Middle harbor	Diffuser	170° 40'	1.678°	-03W	14° 16'	58.934° -586
15	Middle harbor	ZOM Edge, N.	170° 40'	6.243°	-12W	14° 16'	45.692° -776
16	Middle harbor	ZOM Edge, W.	170° 40'	13.483°	-17W	14° 16'	57.273° -666
17	Middle harbor	ZOM Edge, E.	170° 40'	1.158°	-01W	14° 16'	54.398° -906
18	Outer harbor	ZOM Edge, S.	170° 39'	59.177°	-08W	14° 17'	8.862° -106

Note: Revised coordinates listed are locations of stations used and reported in CH2M Hill's July 7, 1995 Report, "Results of March 1995 Harbor Water Quality Monitoring Pago Pago Harbor, American Samoa", and are as read from GPS in field. (A correction factor based on readings at known locations may be required for exact station location.) Latitudes for Stations 14 and 16 originally listed in the permit were incorrect and are corrected here.

It is recommended that the stations be located using the sextant angle resection positioning method or a positioning system which affords an equivalent degree of accuracy and precision. Other means may be used if, in the judgment of ASEPA and EPA Region 9, they are of sufficient accuracy and precision to allow reoccupation of the stations within plus or minus six (6) meters.

The following shall constitute the Water Quality Monitoring Program as shown:

Parameter	Units	Stations	Sample Type	Sample Frequency
Temperature	°F	all	grab	continuous (1) monthly/semi-annual (2)
pH	"	"	"	continuous (1) " semi-annual (2)
Dissolved Oxygen	mg/l	"	"	continuous (1) " semi-annual (2)
Suspended Solids	mg/l	"	"	"
Light Penetration	ft.	"	grab	" semi-annual (2)
Turbidity	NTU	"	"	continuous (1) " semi-annual (2)
Salinity	ppt	"	"	continuous (1) " semi-annual (2)
Chlorophyll a (3)	µg/l	"	grab	" semi-annual (2)
Total Nitrogen (3)	µg/l	"	"	" semi-annual (2)
Total Phosphorus (3)	µg/l	"	"	" semi-annual (2)
Total Ammonia (3)	µg/l	"	"	" semi-annual (2)
Lead	µg/l	(4)	"	semi-annual (2)
Copper	µg/l	(4)	"	semi-annual (2)

(1) Continuous vertical profiles.

(2) Sampling to occur approximately every 6 months to coincide with the two main oceanographic seasons.

(3) Samples to be taken at the following depths where possible: near surface, 30, 60, 90 and 120 feet, and near bottom. Where water depth is less than 120 feet, a minimum of three samples shall be taken at each station (near surface, mid-depth and near bottom).

(4) The following stations shall be sampled at the noted depths:  
 Stations 5, 5A, 15, 16 18: 30 feet, 120 feet, near bottom;  
 Stations 11 and 13: near surface and near bottom.  
 The number of stations and samples may be adjusted based on the results of the first sampling episode, upon approval by USEPA and ASEP.

Measurements should be taken at three depths for each location: 1 meter above the bottom, 1 meter below the surface, and at mid depth.

A study plan which includes standard operating procedures for receiving water quality measurements will be developed and submitted to ASEP and USEPA for approval within 30 days of the effective date of this revision.

## **Appendix II**

### **Combined Sampling and Analysis Plan and Standard Operating Procedures**

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Plan of Study  
for  
Receiving Water Quality Sampling  
Pago Pago Harbor, American Samoa

A Combined  
Sampling and Analysis Plan  
and  
Standard Operating Procedures

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Prepared for

StarKist Samoa (NPDES Permit AS0000019)  
and  
VCS Samoa Packing (NPDES Permit AS0000027)

Submitted to

United States Environmental Protection Agency  
and  
American Samoa Environmental Protection Agency

Prepared by

**CHM HILL**  
and  
Glatzel and Associates

October 1996 : Revision 2

## **Purpose**

On 8 November 1995 the U.S. Environmental Protection Agency issued a modification to the receiving water quality monitoring requirements of the NPDES permits issued to StarKist Samoa and VCS Samoa Packing. This combined sampling and analysis plan and standard operating procedures (SAP/SOP) has been prepared in compliance with the permits and to maintain a consistent and acceptable quality of data for the monitoring program. This plan has been revised based on experience with the first water quality sampling episode in March 1996. The revisions are minor and consistent with the recommendations that will be presented in report of the March 1996 monitoring.

## **Scope**

The data collection and sampling requirements of the permits are listed in this document, including that supporting or ancillary data not directly referenced in the permit but of value in interpreting results. The SAP/SOP also addresses the sample location and navigation methods to be used and the specific methods to be used to take field measurements and collect, process, store and ship sea water samples. Quality assurance and quality control (QA/QC) and reporting format are also discussed. It is assumed that the field team will be familiar with the types of oceanographic equipment to be used and detailed instructions for the correct use of such equipment is generally not discussed.

## **Data and Samples Description**

The permit requires the in-field measurement of the following variables as continuous vertical profiles: temperature, pH, dissolved oxygen (DO), turbidity, and salinity. In addition a measurement of light penetration is required. The permit also requires the collection of samples for laboratory analysis of chlorophyll-a, total nitrogen, total phosphorous, and total ammonia at all stations. In addition, analyses for zinc and copper are required at selected stations. In support of the primary data collection and sampling the following information will be recorded at each location at the time of sampling and data collection: date, time, personnel present, total water depth, and general meteorological conditions including wind speed and direction, sea state, precipitation condition, and cloud cover.

## **Sampling Locations and Times**

Sampling is to be done twice a year during the two main oceanographic seasons. The two oceanographic seasons are the tradewind and non-tradewind seasons, which are separated by short transition periods. Other studies being conducted under the permit are also aligned with these seasons. Sampling will normally be scheduled for the February-March and August-September-October time periods.

Sampling and data measurement locations consist of twenty (20) stations located throughout Pago Pago harbor and described by latitude and longitude and graphically in

the permit and permit modification. At each station location continuous vertical profiles will be taken, other data as described above will be recorded, and samples will be collected at the following depths: near surface, 30 feet, 60 feet, 90 feet, 120 feet, and near bottom. Where water depth is less than 120 feet samples will be collected at three depths including: near surface mid-depth, and near bottom. The sample collection for metals is abbreviated and samples will be collected at three depths (30 feet, 120 feet, and near bottom) at five (5) stations and at surface and near bottom at two stations. The stations for metals sampling are specified in the permit modification.

Station locations are specified in the permit both by latitude and longitude and graphically. Problems have been encountered previously in correlating the latitude-longitude coordinates with known or charted positions in Pago Pago Harbor. There are at least three datums in use in various references: Preliminary NAD (North American Datum) 1927, NAD 1927, and NAD 1983 which essentially corresponds to WGS (World Geodetic System) 1984 as typically used in satellite navigation systems and global positioning systems (GPS). Therefore, latitudes and longitudes derived from different sources can be significantly different for the same point or feature on the ground. The procedure described below will be used to avoid confusion in the future.

GPS positioning will be used for station locations. During the first data collection episode We will recorded, and permanently store, the WGS coordinates of the stations actually occupied for this sampling and will use the same coordinates for all future sampling episodes. Since differential GPS is not yet available in American Samoa one of two methods will be used for station location: installation of a base unit at a known bench mark or, during each sampling two known bench marks will be visited and the appropriate corrections will be recorded and applied to determine the station location. These methods should provide sufficient accuracy for water quality sampling (the occupation at two benchmarks will also provide an estimate of precision).

### **Sample Collection**

Water samples will be collected from each depth specified in the permit using a Niskin type sampling bottle. Following the determination of total water depth as described below, the collection bottle will be lowered to the appropriate depth using a measured line and allowed to hang for a minimum of 1 minute. The bottle will then be triggered by a messenger dropped down the line and the bottle retrieved. Sample bottles, as described in Table 1, will be immediately filled and preserved as indicated in the table, stored on ice, and prepared for shipment to the laboratory. In addition, a minimum of two liters will be collected and stored on ice for chlorophyll-a filtering and analysis. The chlorophyll samples will be filtered through a Whatman grade GF/F glass microfiber filter paper (0.7 micron) using a vacuum pump apparatus within twenty-four hours of sample collection. The filters will be treated with manganese sulfate as a preservative and then stored in a freezer until being sent to the laboratory for analysis.

## **Parameter Measurements**

As described above, in addition to the required continuous vertical profiles, the following information will be recorded at each location at the time of sampling and at the time of profile collection (if different): date, time, personnel present, total water depth, and general meteorological conditions including wind speed and direction, sea state, precipitation condition, and cloud cover. The continuous profiles may be taken at the same time or at different times from the sample collection. If the profiling is done at a different time, the same information listed above will be recorded. Also a measure of light penetration, as described by Secchi depth will be collected at each station either during the time of sample collection or vertical profiling. The various parameters will be measured as follows:

- Water depth will be measured using a non-recording portable fathometer or a measured and marked lead line
- Secchi depth will be determined by using a standard size and patterned Secchi disk lowered through the water column on a measured line
- Wind speed and direction will be estimated using a small hand held anemometer and compass
- Other meteorological parameters will be estimated visually

Conductivity, temperature, depth (pressure), DO, pH, and turbidity will be measured using an internally recording profiling instrument (CTD) which has been calibrated by the manufacturer prior to shipment to American Samoa. Salinity and sea water density will be calculated from conductivity and temperature using the manufactures supplied software or other appropriate formulations. Backup instruments for all parameters will be available in case of failure of any or all of the profiling sensors. In such a case measurements will be taken using the individual grab samples.

The profiling instrument to be used should be tested dockside in a side-by-side test with calibrated meters for each parameter. This should be done prior to any sample collection. If any parameters recorded by the profiling instrument are not being measured and recorded in a satisfactory manner, alternative measurements should be taken. These alternative measurements should be done as follows:

- Temperature and DO must be measured in each individual grab sample at the time of sample collection
- Conductivity (salinity and density) and pH may be measured at the time of sample collection, or measured in subsamples from the samples to be filtered for chlorophyll-a analysis
- Turbidity will be measured in the laboratory at the time of nutrient analysis; this requires no extra sample collection and simply needs to be indicated on the chain of custody forms

## **Sample Handling**

The general procedure for handling samples is outlined below. Note that special procedures for the chlorophyll-a samples are discussed above. In the field, sample collection should use the following procedure:

- Label the individual grab sample containers as listed in Table 1 with an appropriate and unique sample identifier and date and time, bottles should be pre-labeled prior to sample collection in the field
- Fill the bottles to the top, and cover the container securely with its lid.
- Store all samples in coolers on ice at a temperature of approximately 4 °C until packaging for shipment to the laboratory.

One chain-of-custody form is required for each cooler of samples that will be shipped. Sample identification on the chain-of-custody should match the labels on the sample containers exactly. Any multiple samples or backup samples must be appropriately indicated on the chain of custody form. The methods requested should be shown on the chain of custody form. Also, note on the chain-of-custody form that samples are sea water.

Prior to shipping, acid preserved samples should be checked for pH and the pH should be adjusted as necessary to meet the requirements listed in Table 1. Each glass sample bottle should be wrapped in bubble-wrap or an equivalent packaging material and placed in a plastic zip-lock bag. Plastic sample bottles should be placed in a plastic zip-lock bags as well. As much air as possible should be removed from the bag prior to sealing it. Too much air inside the bags will expand during the flight and pop the bag open. Place sample bottles inside the cooler. Packaging material (bubble wrap or equivalent) should be placed in the cooler to prevent bottles from moving and impacting each other.

Ice or an equivalent means (such as chemical cold packs) must be included to keep the samples cold during shipping. Do not use dry ice to pack the samples. If ice is used, precautions should be taken to prevent melted ice from leaking out of the cooler during shipping. These include taping any drain plugs in the cooler shut with duct tape or strapping tape, and "double-bagging" the ice cubes in zip-lock bags. As with the bags used to hold the sample bottles, as much air as possible should be removed from the bags prior to sealing.

The chain-of-custody form for each cooler should be signed, placed in a zip-lock bag, and taped with duct tape to the inside of the cooler lid. The cooler should be taped securely shut with strapping tape or other strong packaging tape to prevent it from opening during shipping.

## **Quality Assurance And Quality Control**

The quality assurance and quality control objectives for the study are to collect physical and hydrographic data and representative samples at predetermined locations and provide



field and laboratory measurements that are of known and acceptable quality. A list of field equipment is given in Table 2. The following requirements will be followed to meet the objectives:

- Maintain and document accurate positioning for sample collection
- Verify the GPS at known points near or within the study area
- Provide field equipment redundancy (backup equipment)
- Develop and use the field standard operations procedures (SOP) as described in this document
- Obtain all equipment prior to the beginning of the field collections and check to verify correct operation
- Any instrument requiring calibration will be checked and calibrated upon its arrival to confirm that it is in working condition.
- Examine samples as collected and subsequent data analysis by experienced scientists
- Provide verifiable laboratory chemical analyses with appropriate QA to evaluate accuracy and precision targets

### **Health and Safety Considerations**

The data and sample collection and preparation should be done or directly supervised by staff that are experienced with this type of work and are fully aware of all health and safety practices that apply in such cases.

### **Reporting**

A report of the results will be provided to USEPA and ASEPA after receipt and post processing of the results of the chemical sample analyses. Field data will be summarized and positioning data will be tabulated. Laboratory chemical data will be reviewed to determine whether analytical accuracy and precision targets were achieved and to assess the laboratory quality assurance. Chemical analyses results will be presented in tabular formats. Any proposed revisions to the study plan will be presented in the report. Review comments from USEPA and ASEPA will be incorporated into the revised study plan as appropriate.

- An introduction presenting the background, rationale, objectives and setting of the study
- A section describing the approach and methods, including any deviations or changes from the study plan, and justification for any such deviations

- A section presenting summary results of the information gathered
- A section discussing any pertinent conclusions, recommendations, and proposed changes to the study
- Appendices containing the study plan, a record of approvals of any previous changes to the study, the laboratory reports, chain-of-custody records, and any other pertinent information

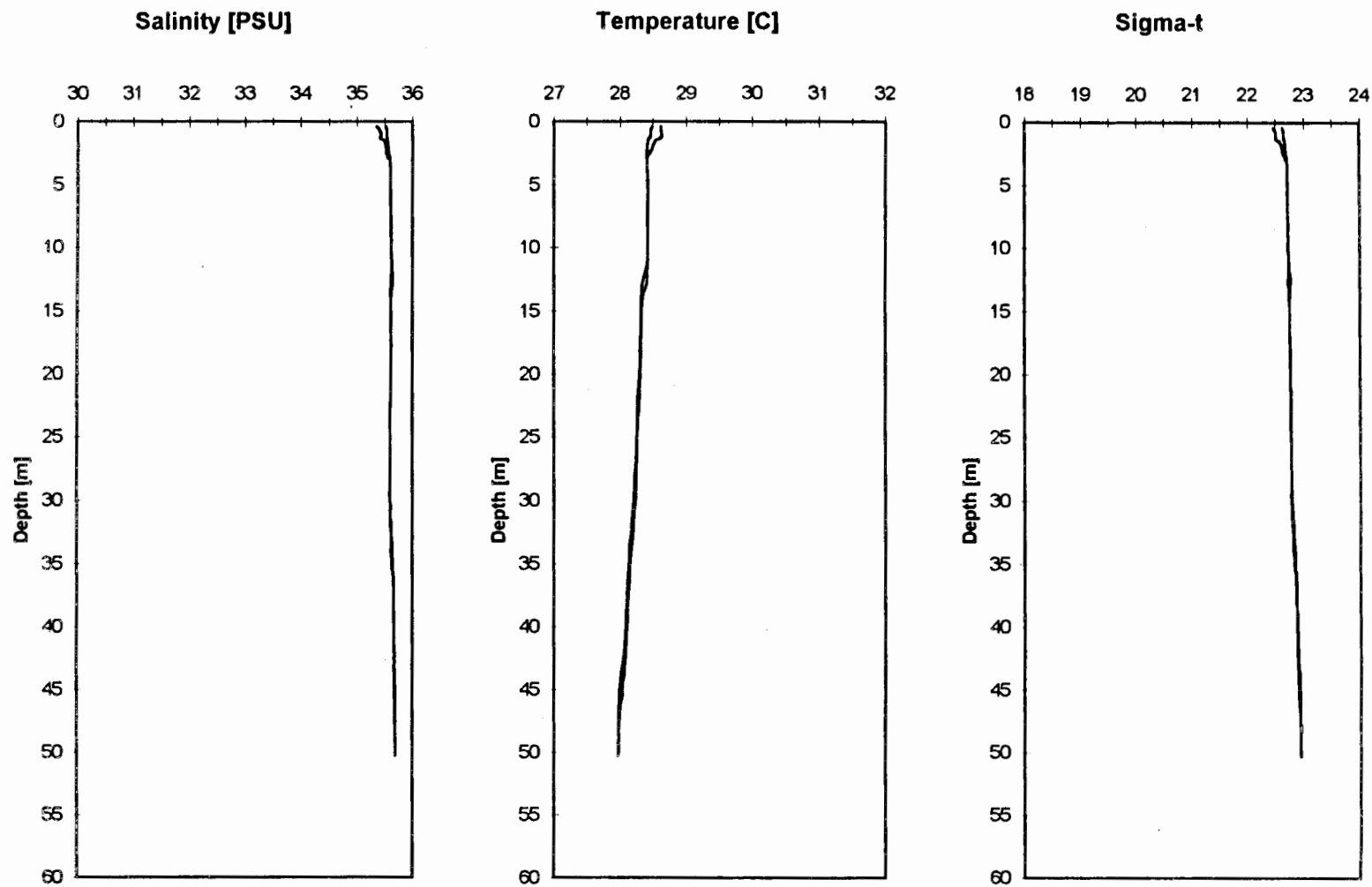
Table 1 Pago Pago Harbor Water Quality Monitoring Sample Analysis And Handling Procedures					
ANALYTE	METHOD	REPORTING DETECTION LIMIT	SAMPLE HOLDING TIME	SAMPLE CONTAINER	SAMPLE PRESERVATION
Temperature	Field Probe	0.1°C	N/A	N/A	none
Salinity	Field Probe	0.1 PSU	N/A	N/A	none
Dissolved O <sub>2</sub>	Field Probe	0.1 mg/l	N/A	N/A	none
pH	Field Probe	0.1 SU	N/A	N/A	none
Turbidity	Field Probe	0.2 NTU	N/A	N/A	none
Turbidity <sup>1</sup>	EPA 180.1	0.01 NTU	48 hours <sup>2</sup>	500 ml plastic	none
Nitrite Nitrogen	EPA 354.1	0.001 mg/l	48 hours <sup>2</sup>	2 - 500 ml plastic	4°C - H <sub>2</sub> SO <sub>4</sub>
Nitrate + Nitrite	EPA 353.2	0.010 mg/l	28 days		
Ammonia Nitrogen	EPA 350.1	0.005 mg/l	28 days		
Total Kheldal Nitrogen	EPA 351.3	0.025 mg/l	28 days		
Total Phosphorus	EPA 365.2	0.005 mg/l	28 days		
Chlorophyll-a	SM 1002 G	0.03 mg/m <sup>3</sup>	3 months	Whatman grade GF/F glass microfiber filter (0.7 micron)	frozen, manganese sulfate
Zinc	EPA 200.7	20 µg/l	6 months	500 ml plastic	4°C - HNO <sub>3</sub> to a pH of ≤ 2
Copper	EPA 200.7 <sup>3</sup>	2 µg/l			

Notes:  
<sup>1</sup> Turbidity samples sent to lab from selected stations only to verify probe readings. Stations selected at discretion of filed team leader.  
<sup>2</sup> Holding times for turbidity and nitrite nitrogen are unavoidably exceeded because of logistics involved in shipping from American Samoa. The laboratory (AMTEST) agreed to test for these constituents immediately upon receipt of the samples.  
<sup>3</sup> To be analyzed following extraction by coprecipitation to achieve the requested detection limit

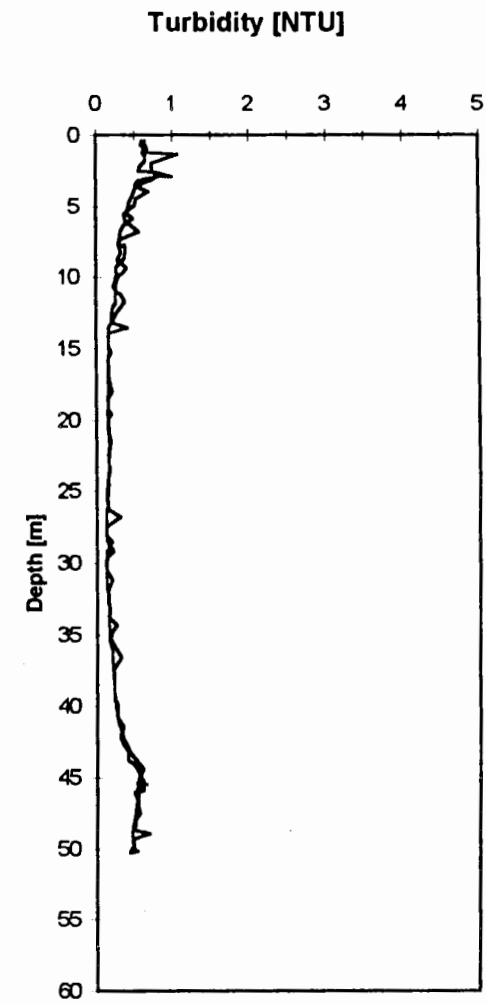
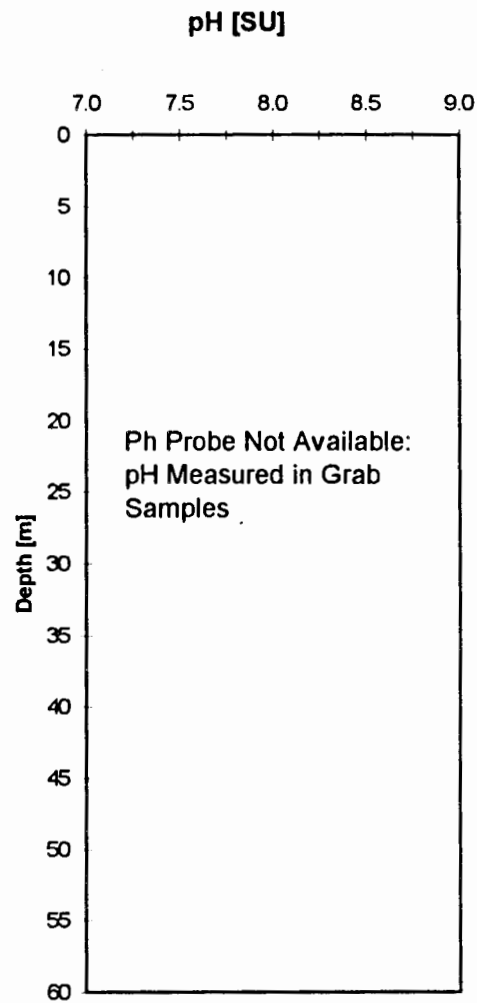
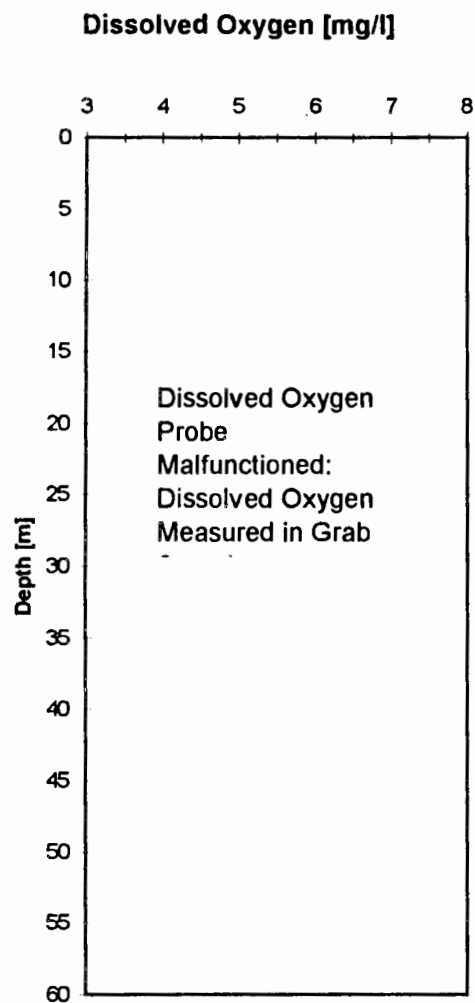
<b>Table 2</b> <b>Field Equipment for Field Data Measurement and Sample Collection</b>			
<b>Equipment Item</b>	<b>Purpose</b>	<b>Number of Units</b>	<b>Accuracy Standard</b>
Work Vessel	Serves as field sampling platform	1	N/A
GPS (or equivalent)	Station positioning system using GPS	1	± 10 meters
Tape measure and/or marked line	Establish depths at sampling locations (backup for fathometer)	1	± 1 foot
Niskin Sampling Bottles (or equivalent)	Collect water samples	2	N/A
Conductivity, Salinity, Temperature (SCT) Meter	Backup for profiling instrument	1	Temp: ± 0.2 °C Cond: ± 0.5 mS/cm Salinity: ± 0.2 PSU
pH Meter	Backup for profiling instrument		pH: ± 0.2 SU
Dissolved Oxygen meter	Backup for profiling instrument	1	DO: ± 0.2 mg/l
Profiling CTD with DO, pH, and Turbidity sensors	Record temperature, conductivity, depth	1	Temp: ± 0.1 °C Cond: ± 0.1 mS/cm Depth: ± 0.1 meter pH: ± 0.2 SU DO: ± 0.2 mg/l Turbidity: ± 0.1 NTU
Vacuum Filtering Apparatus and Filter Paper	Prepare chlorophyll samples	1	N/A
Fathometer	Measure depth at each station	1	± 1 foot
Sample Containers and Preservatives	Collection of receiving water samples for chemical analyses, including sample to be filtered for chlorophyll-a analysis	As required	Pre-cleaned sample containers
Ice Chests	Hold sample jar, cool samples on ice, and ship samples	As required	Pre-cleaned containers
Notes: N/A = Not applicable			

## **Appendix III**

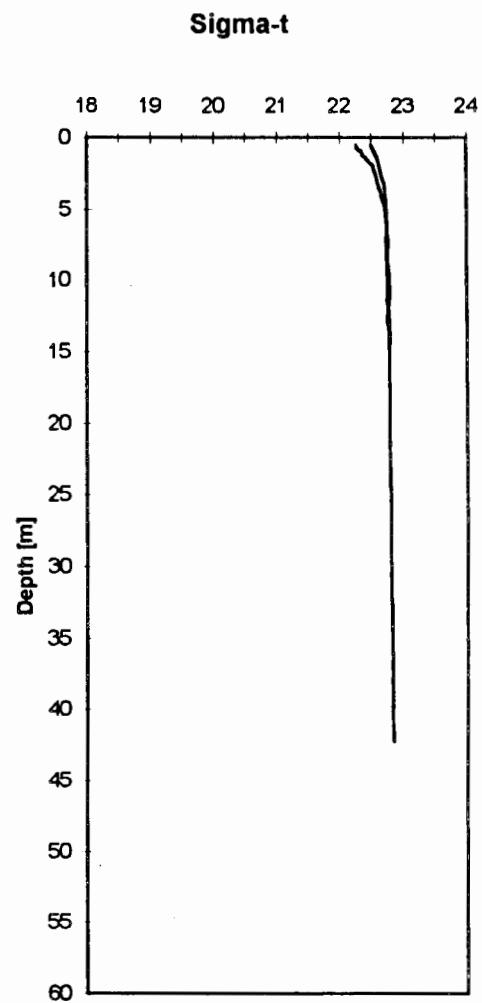
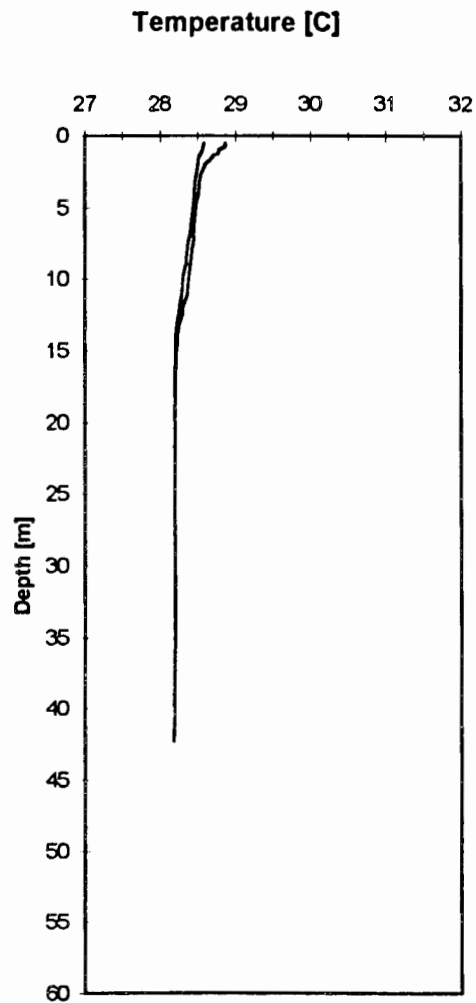
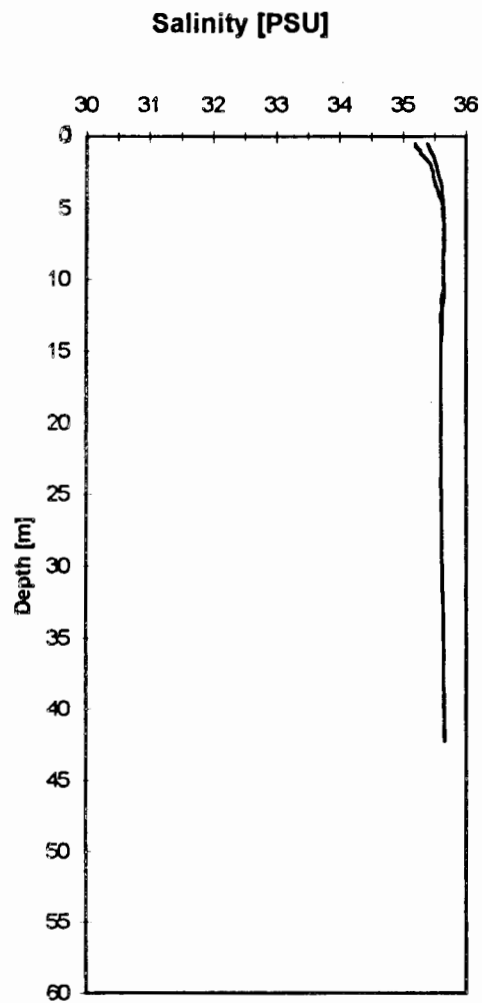
### **Vertical Profile Data for Each Station**



**Station 5**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996

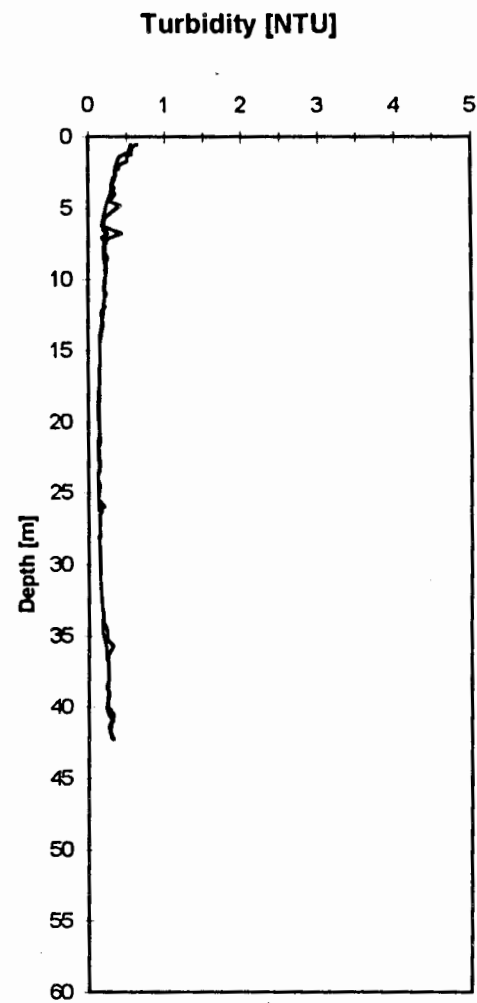
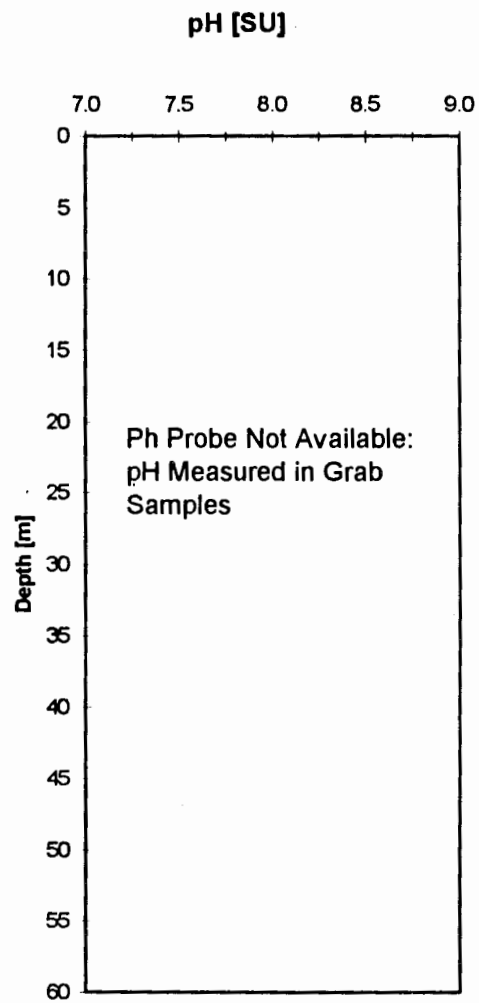
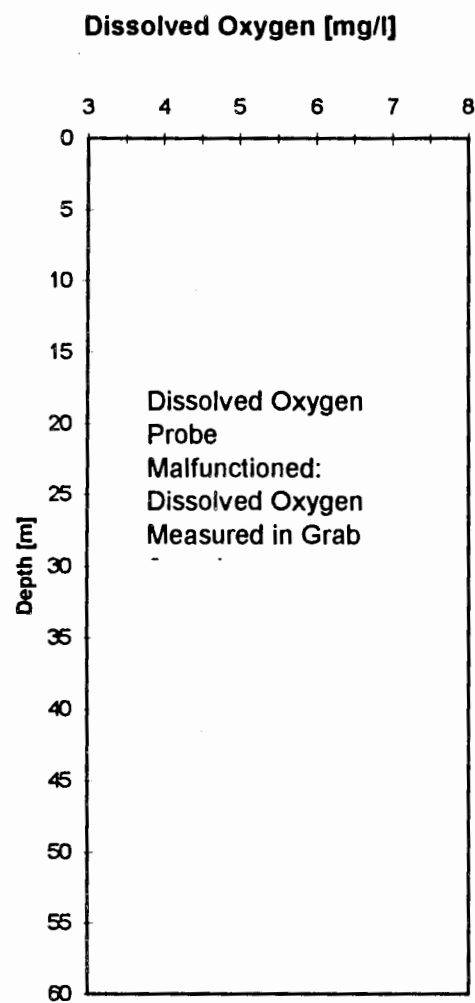


**Station 5**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996

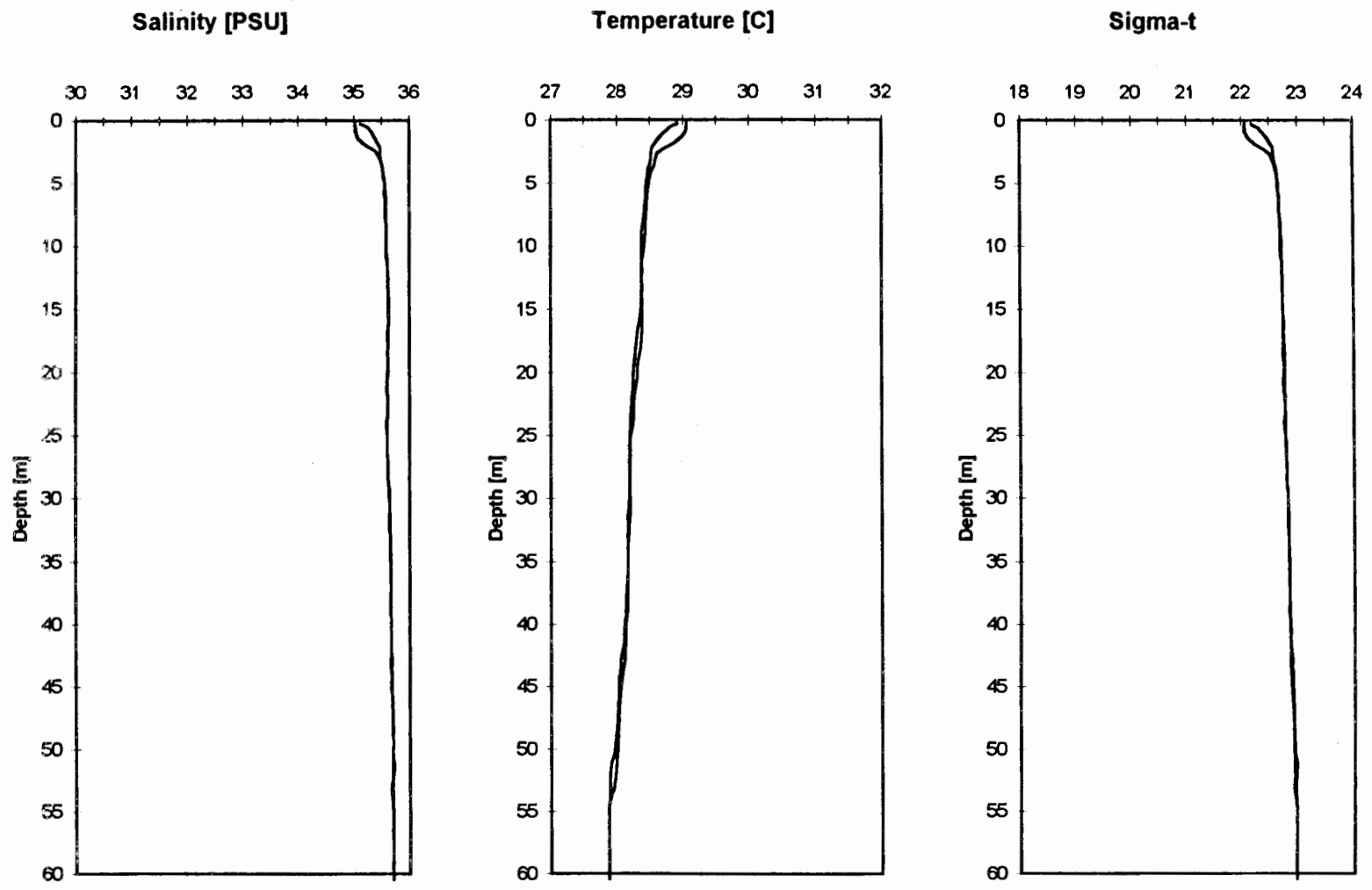


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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996

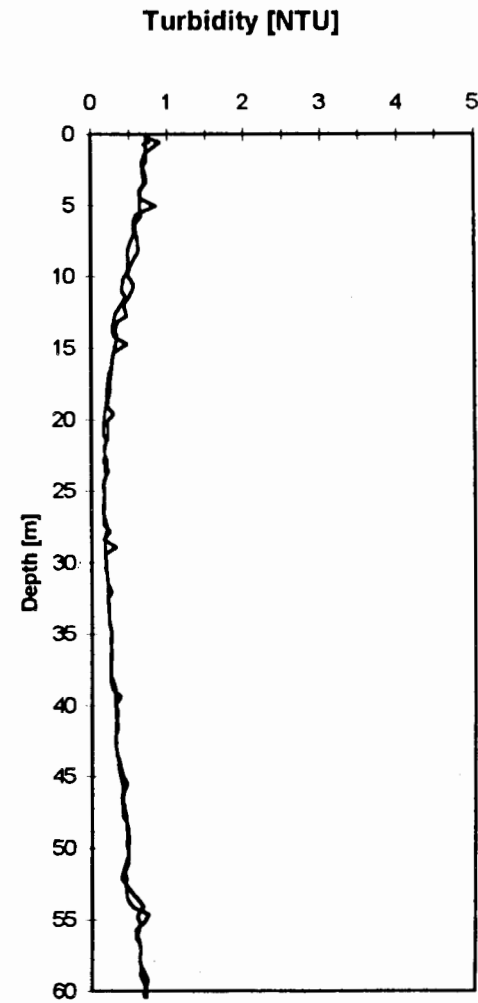
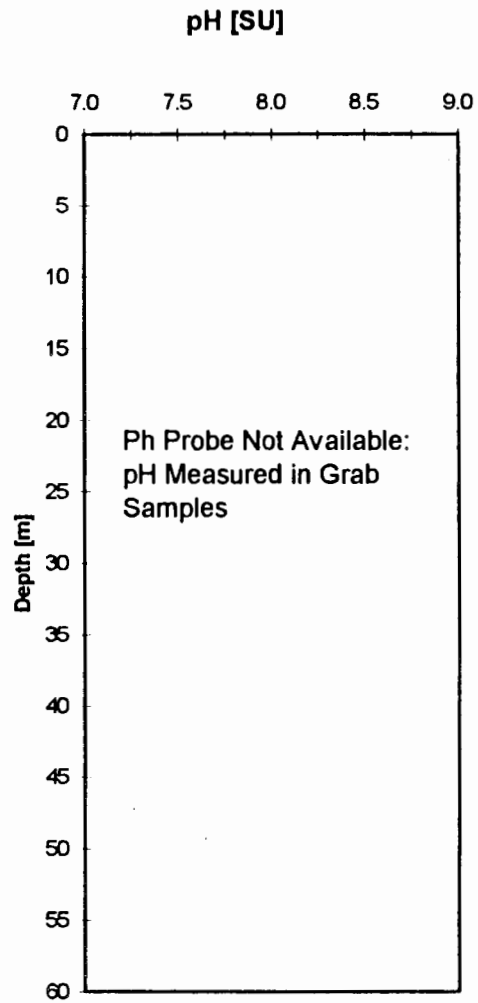
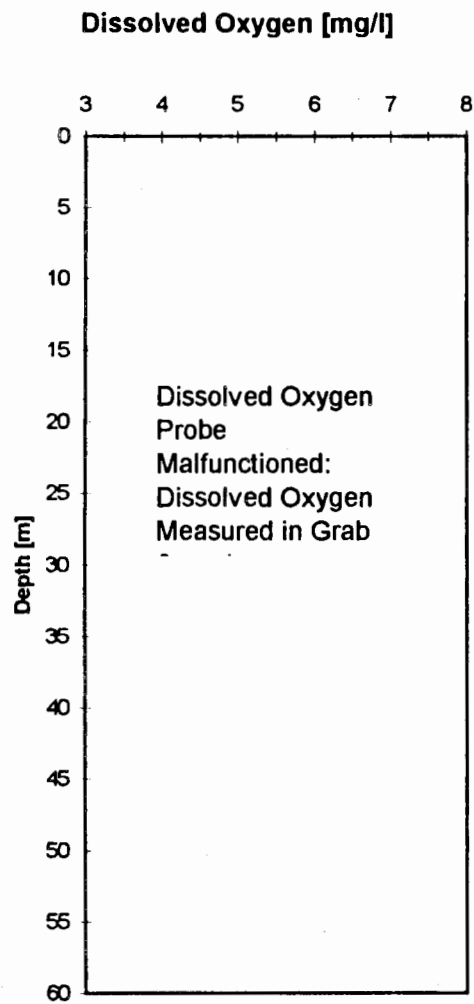




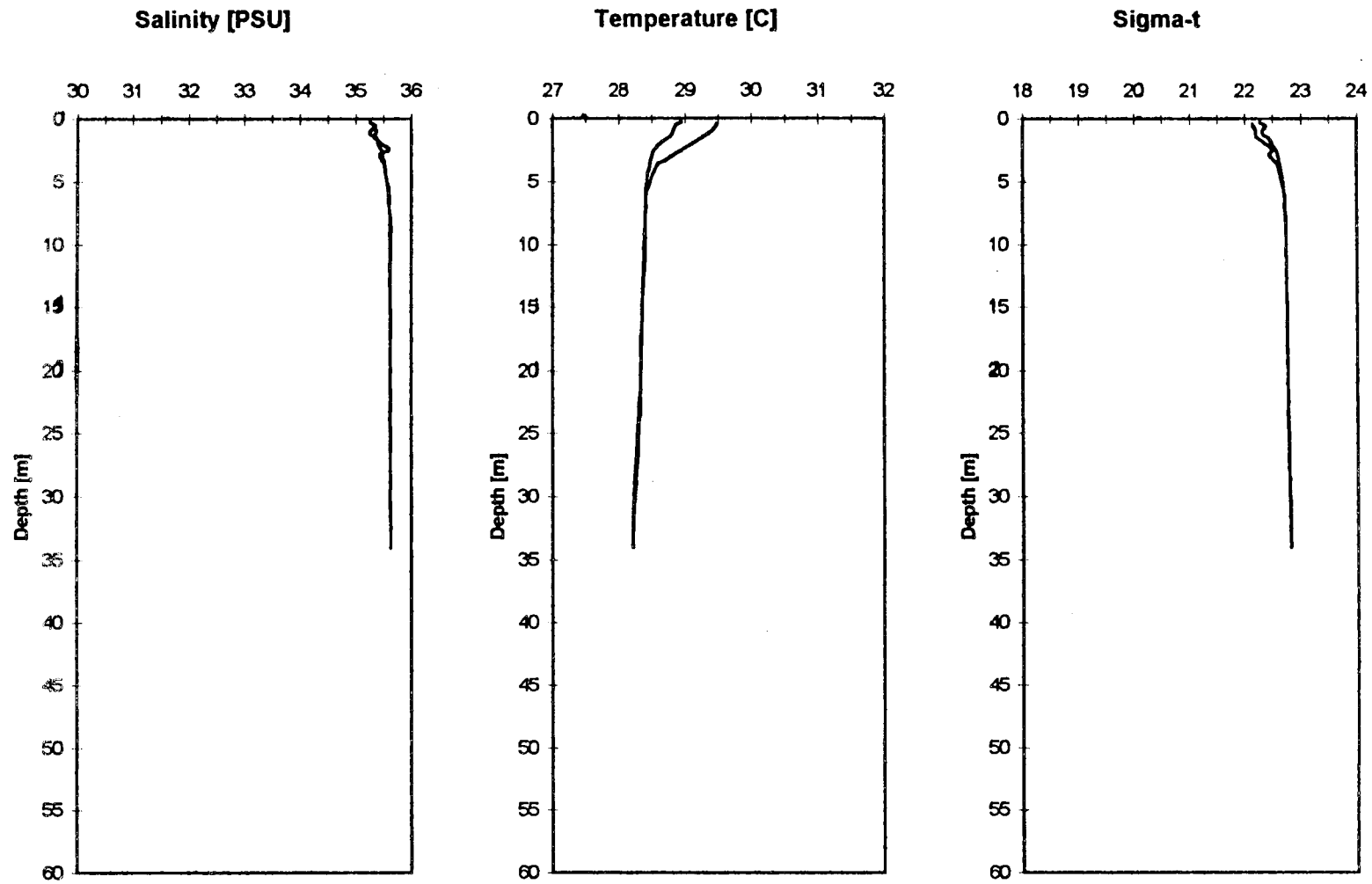
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



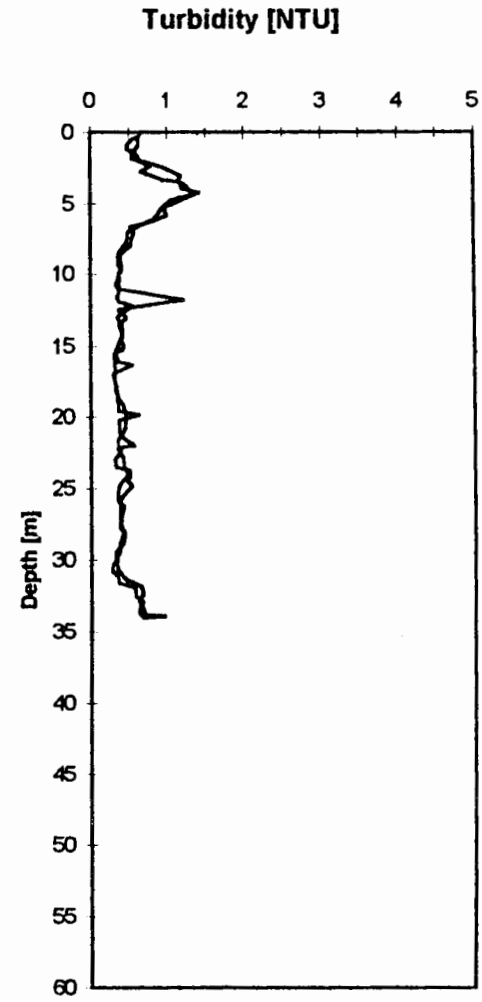
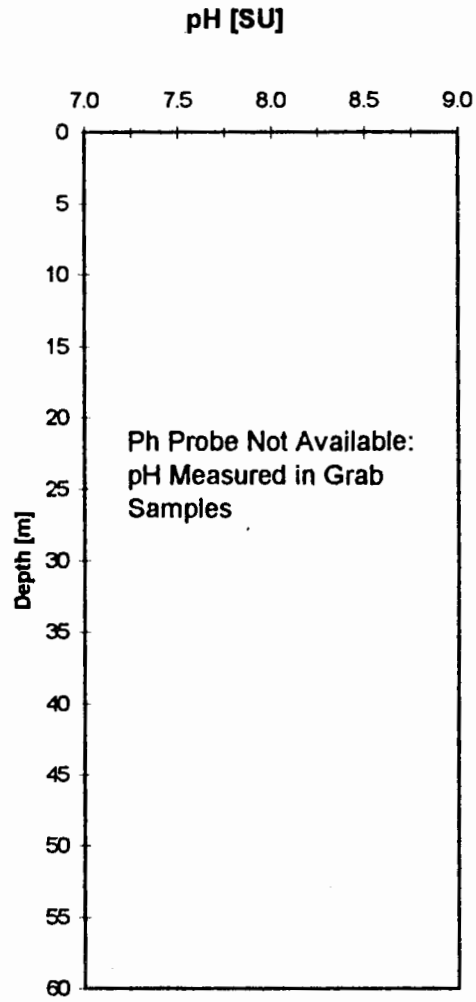
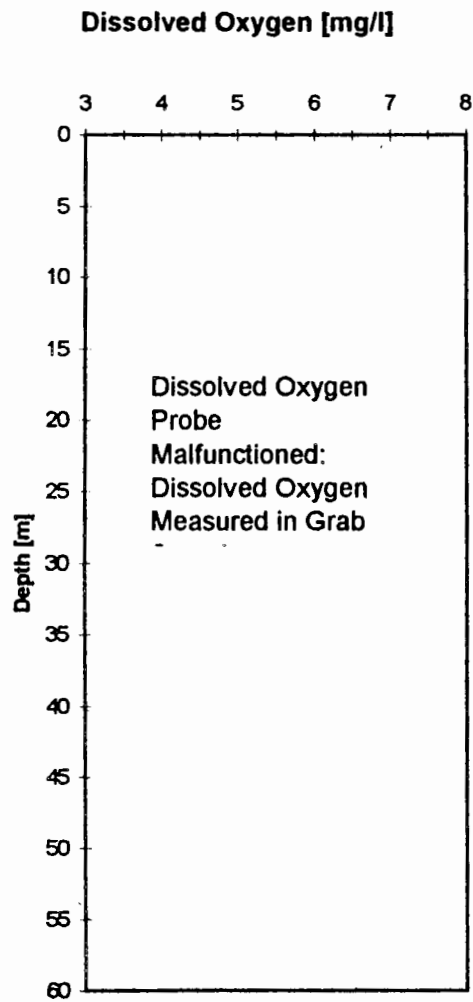
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Salinity, Temperature, and Density  
23 November 1996



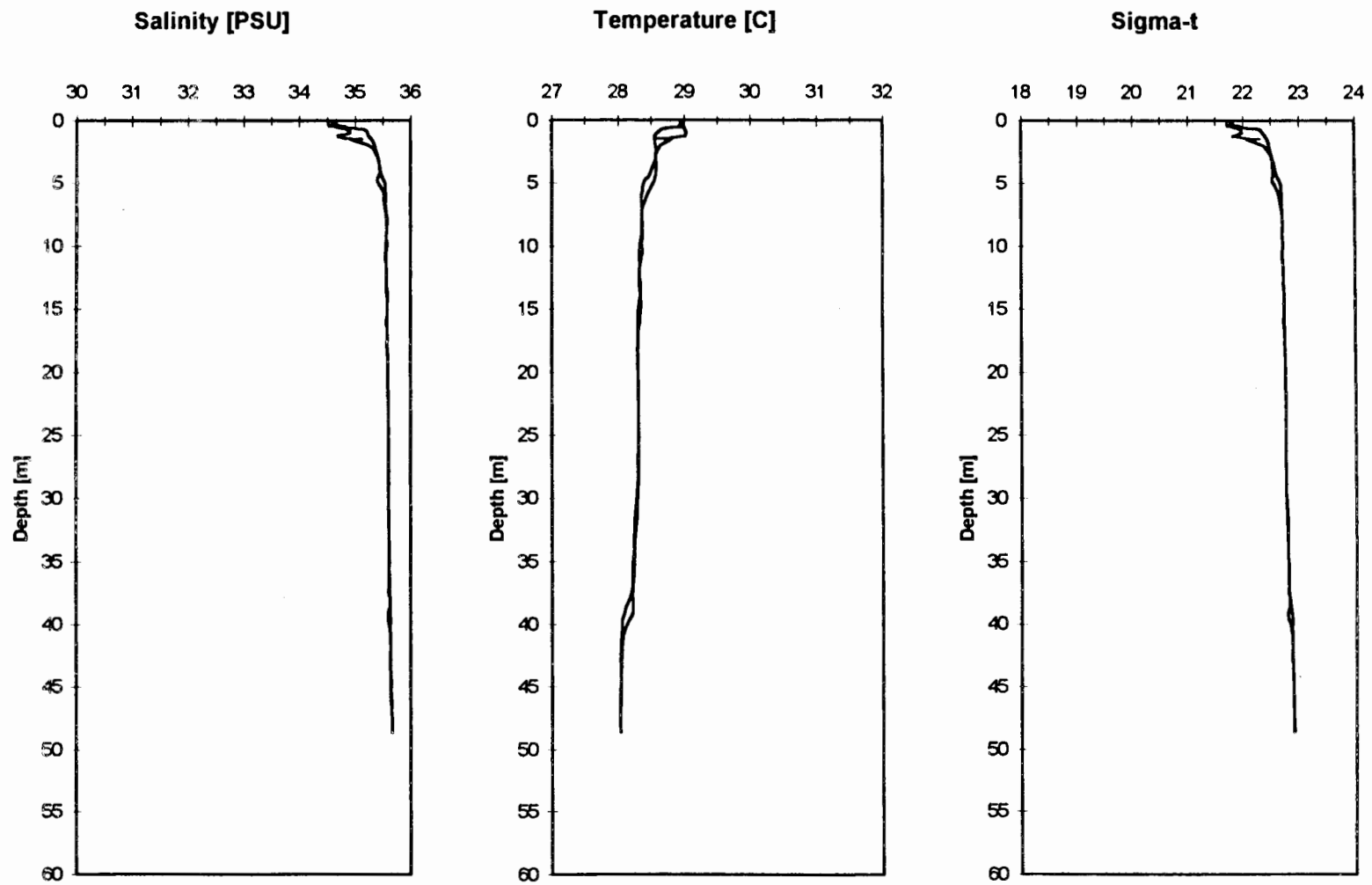
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



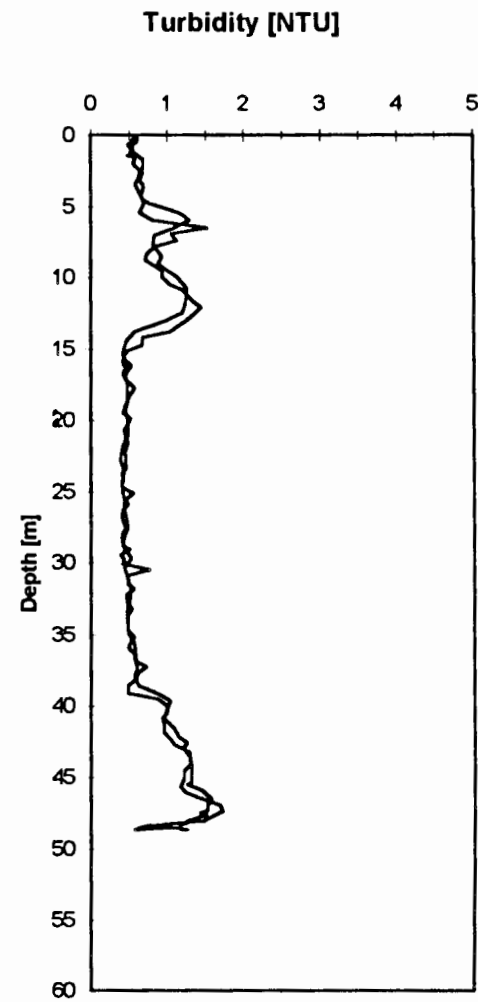
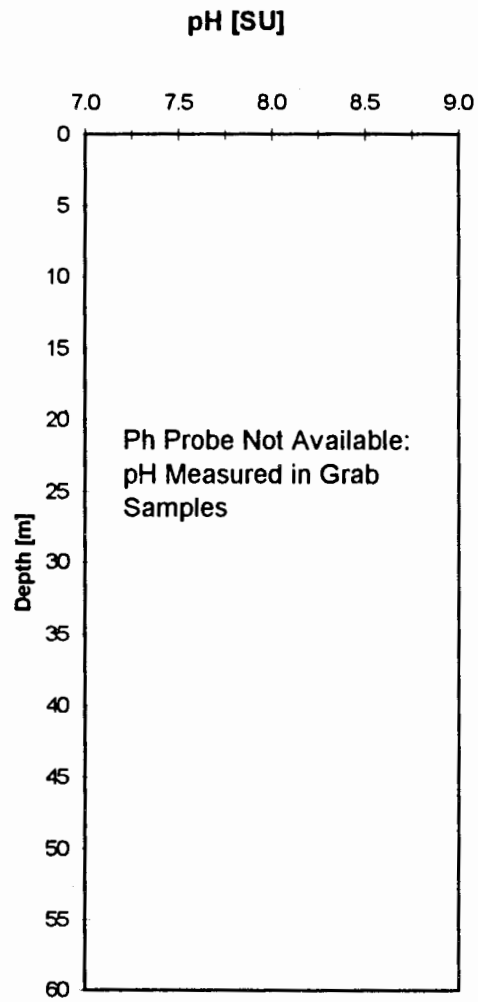
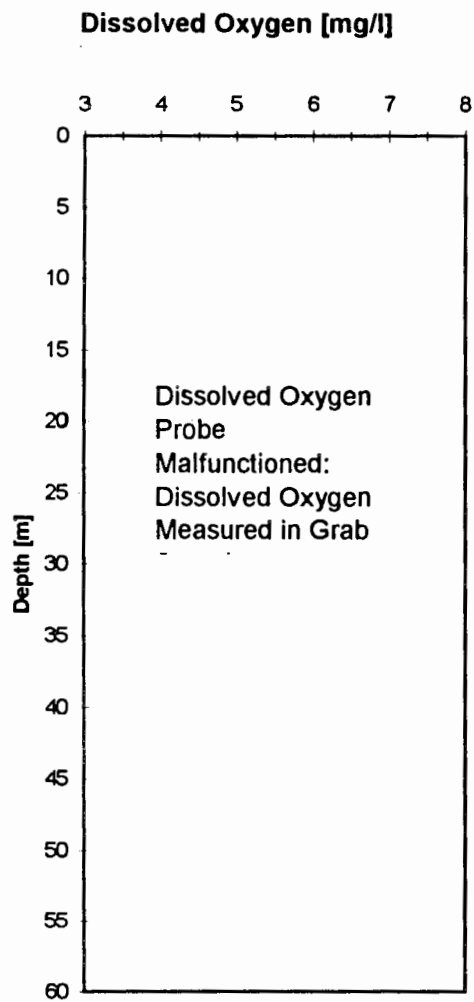
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996



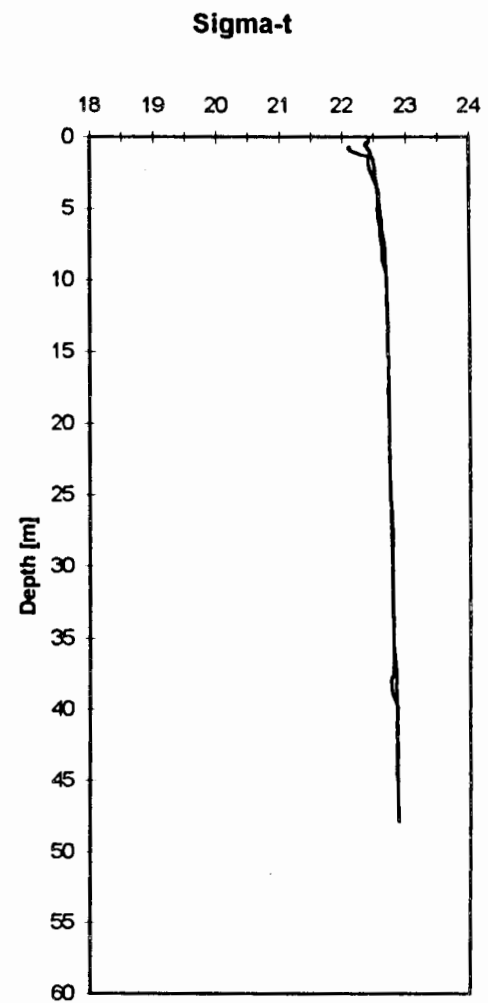
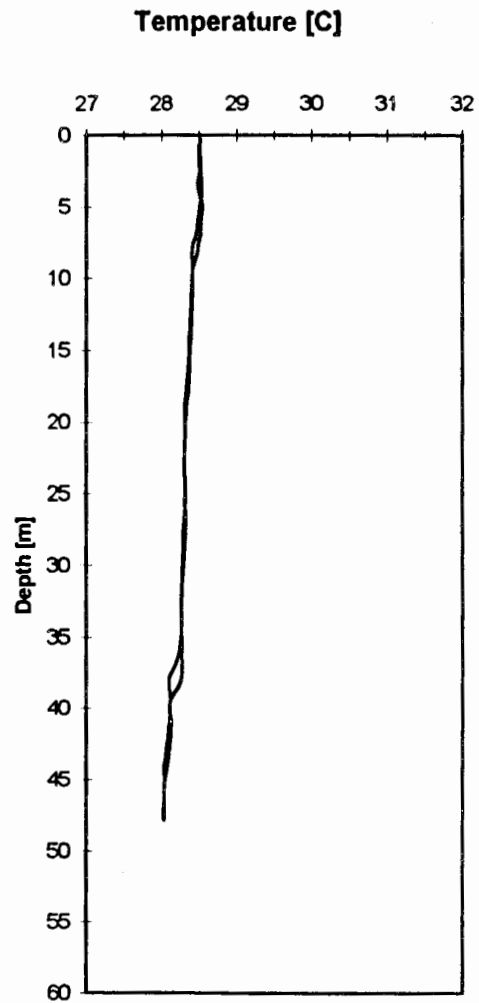
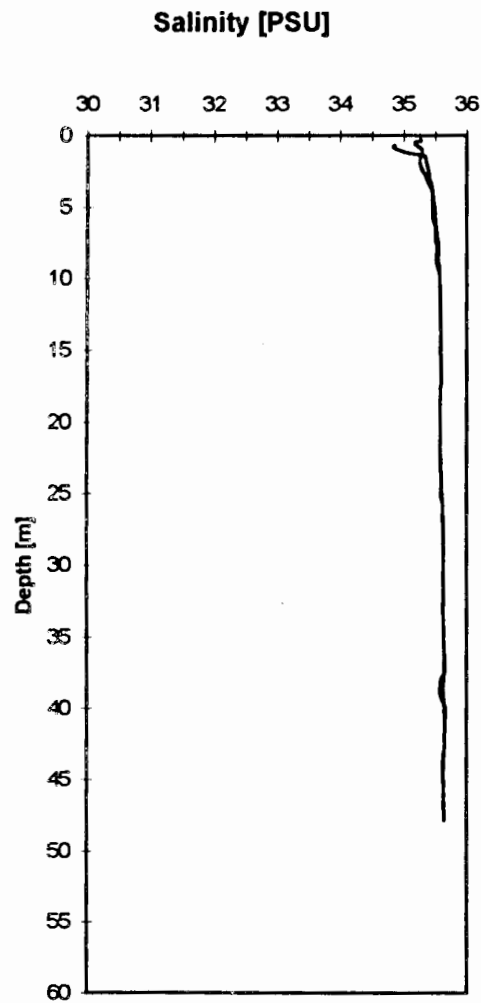
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



**Station 7**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
**Salinity, Temperature, and Density**  
**23 November 1996**

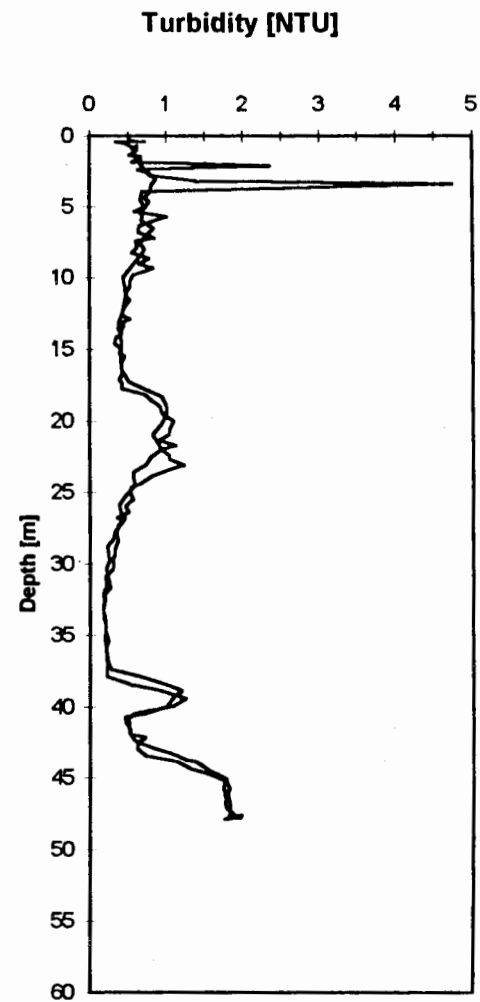
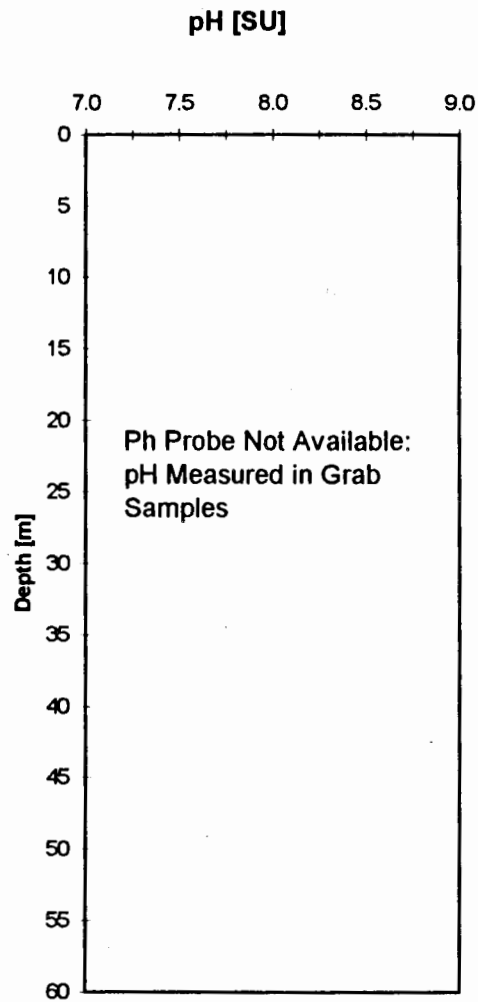
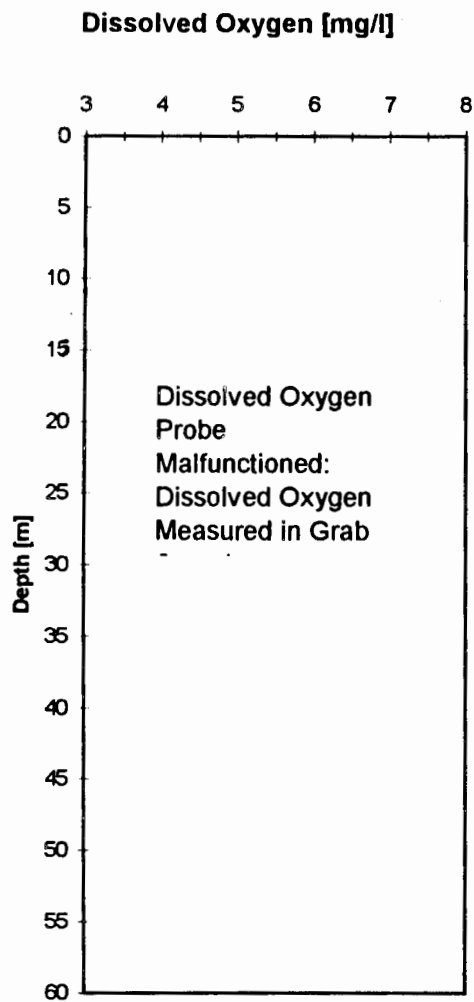


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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996

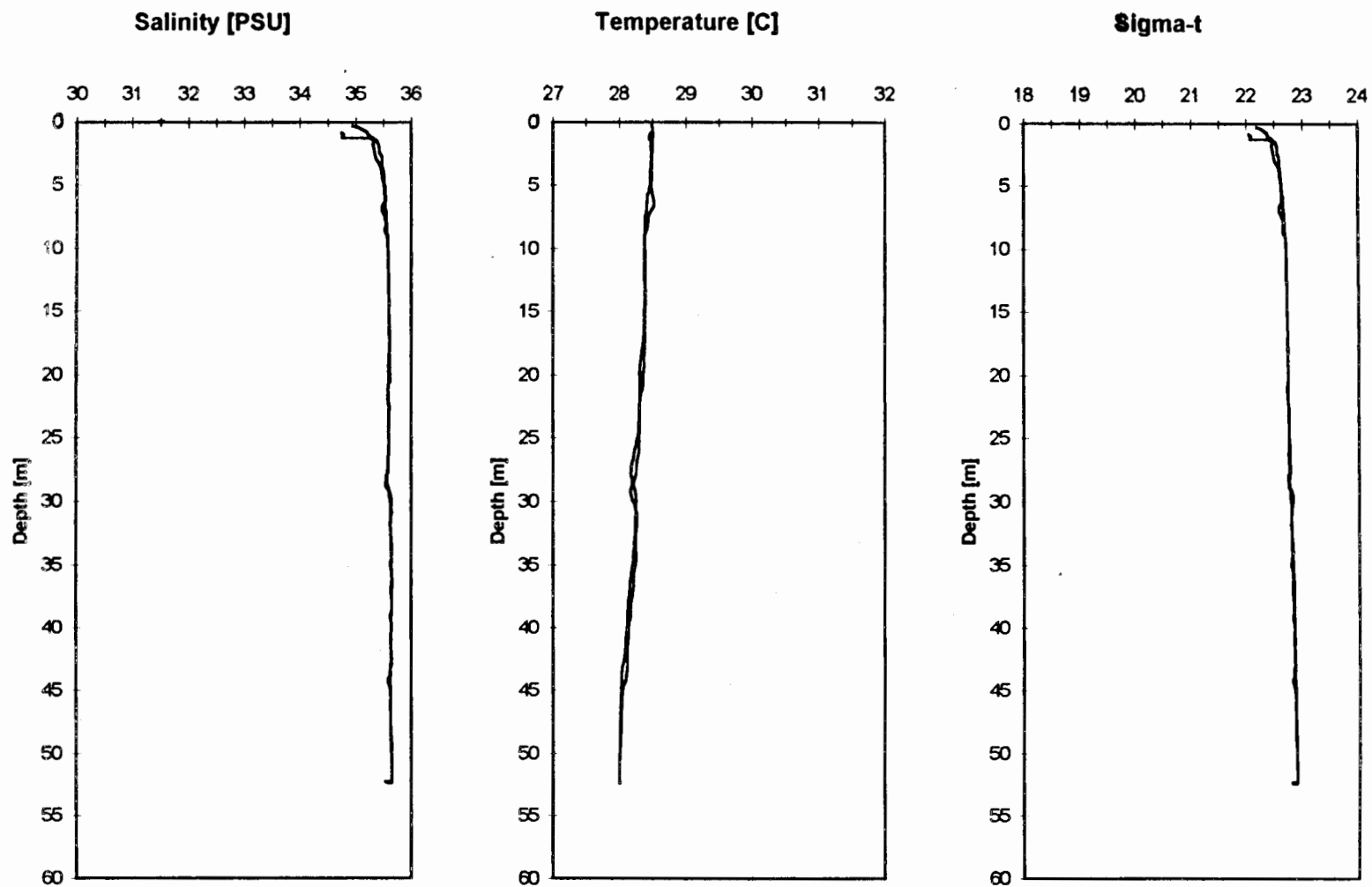


**Station 8**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996

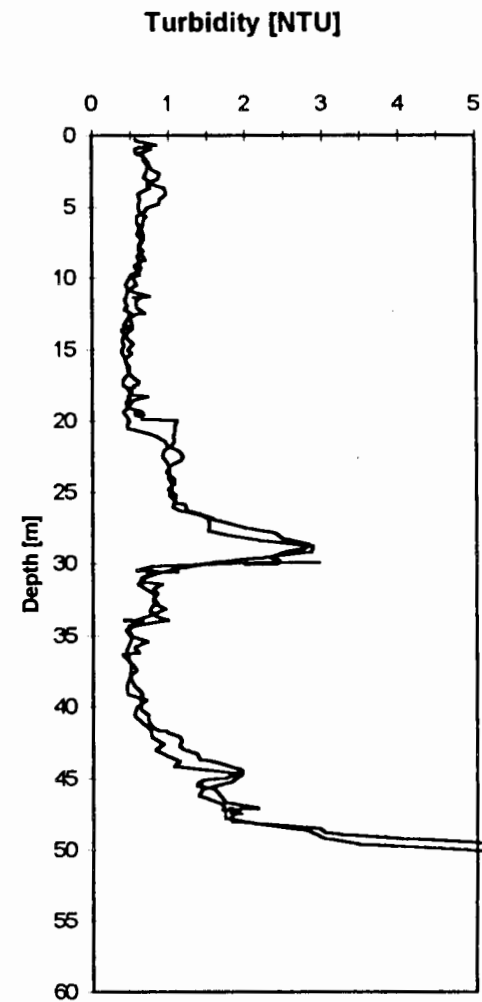
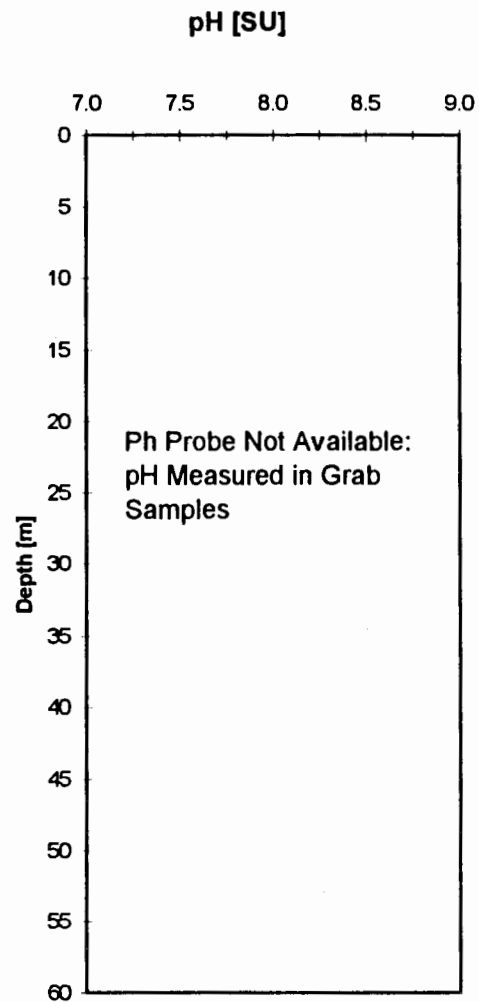
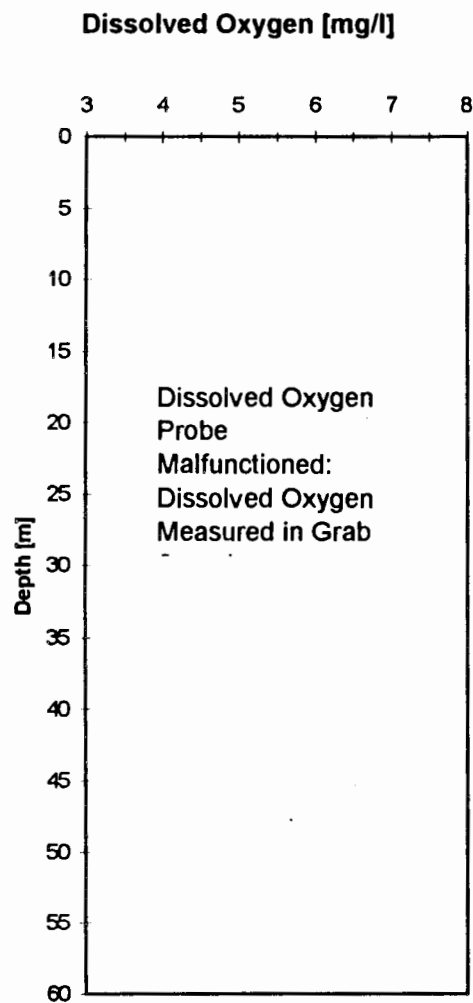




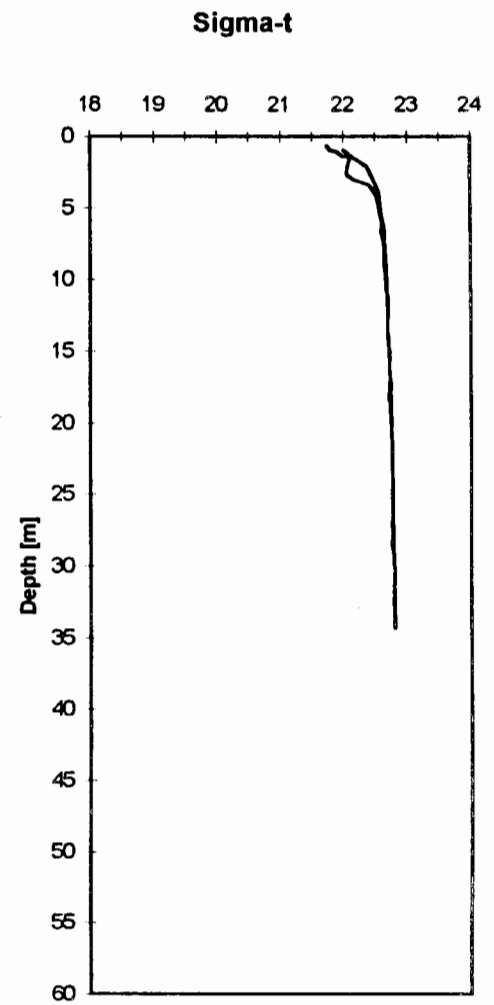
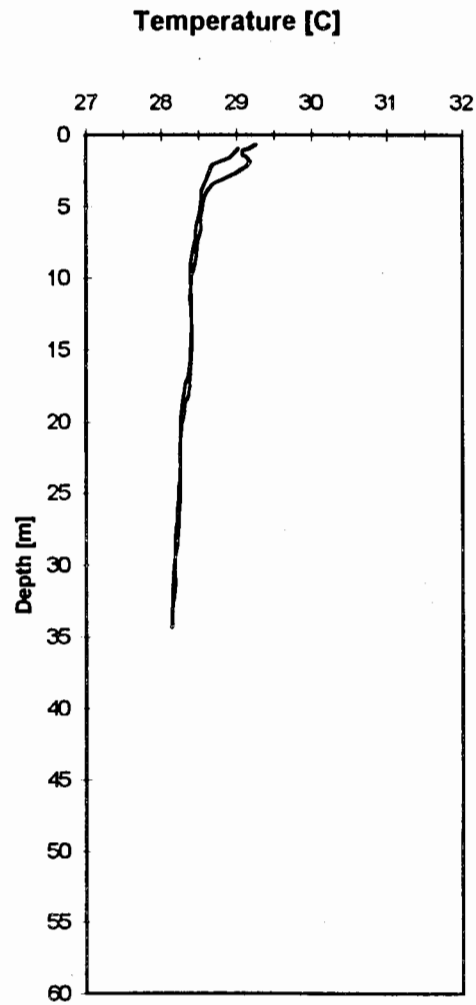
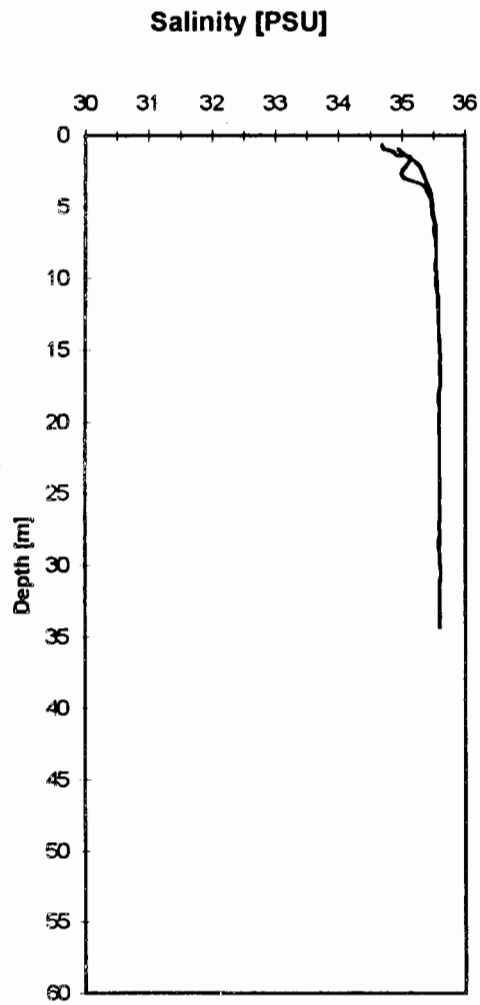
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



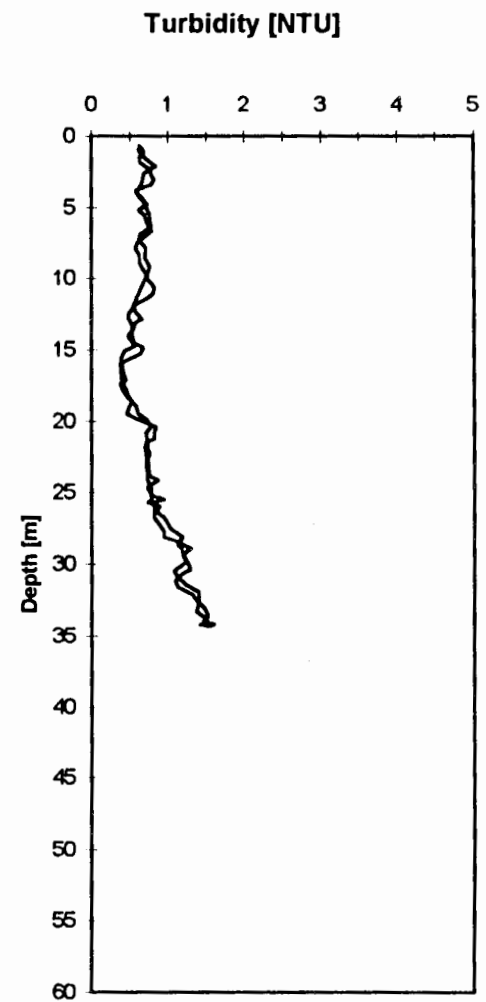
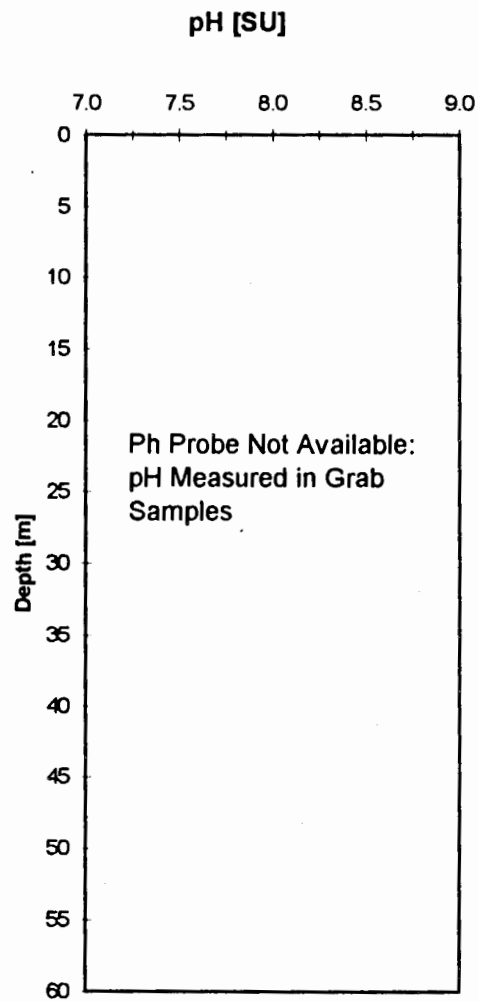
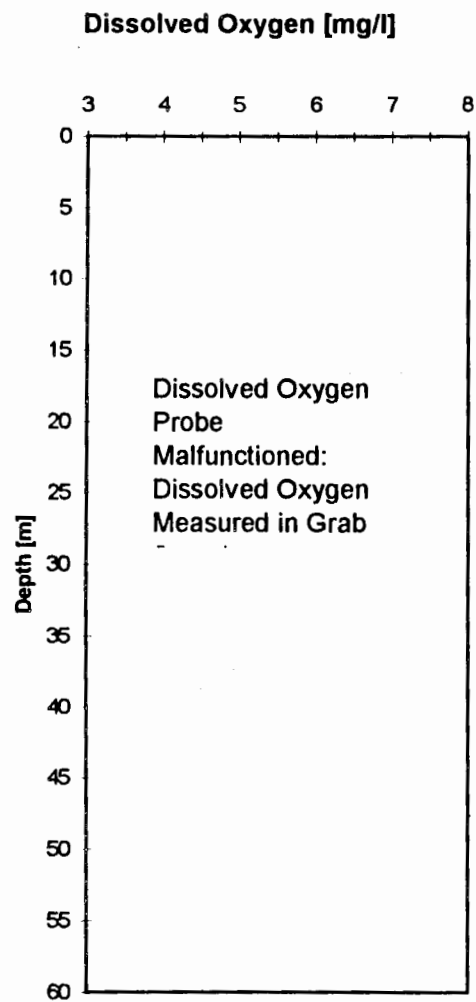
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996



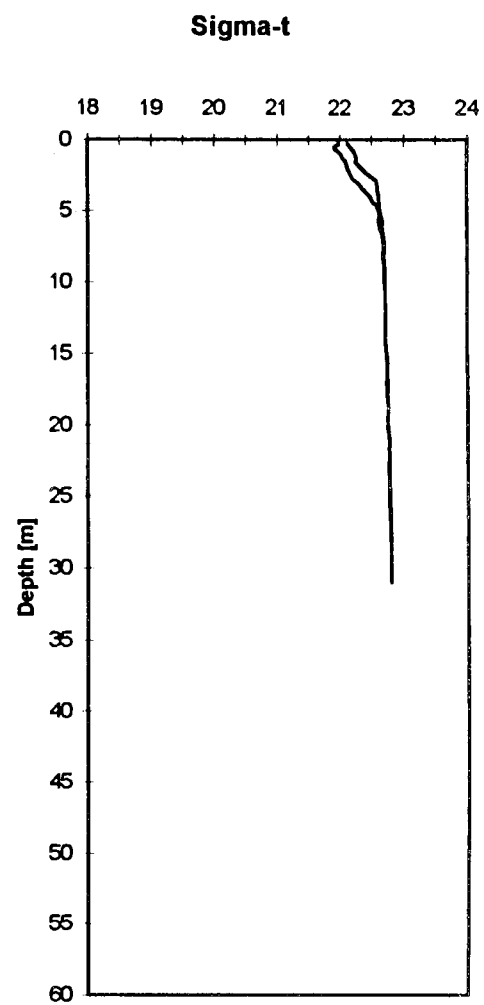
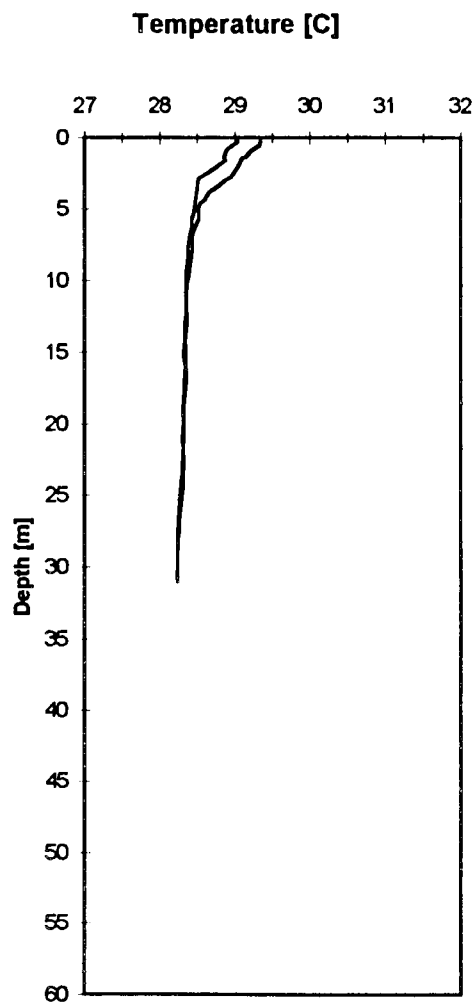
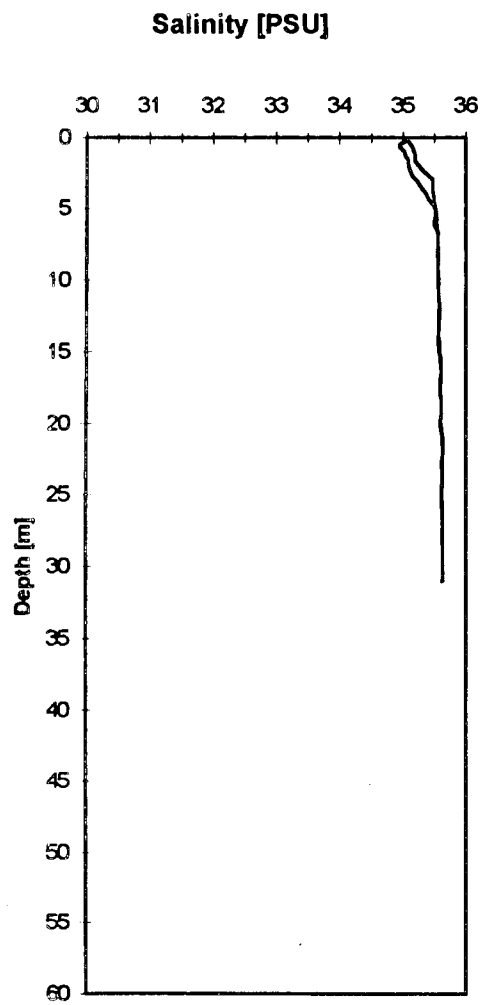
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



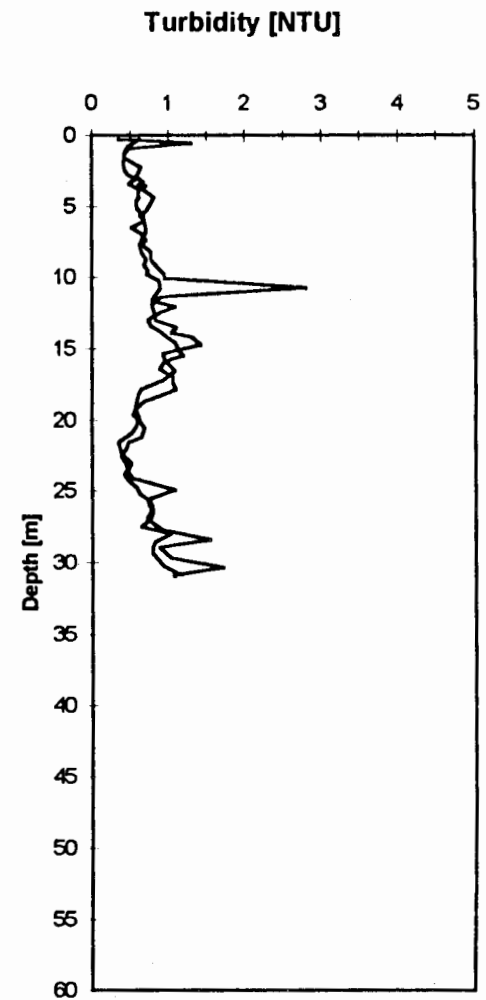
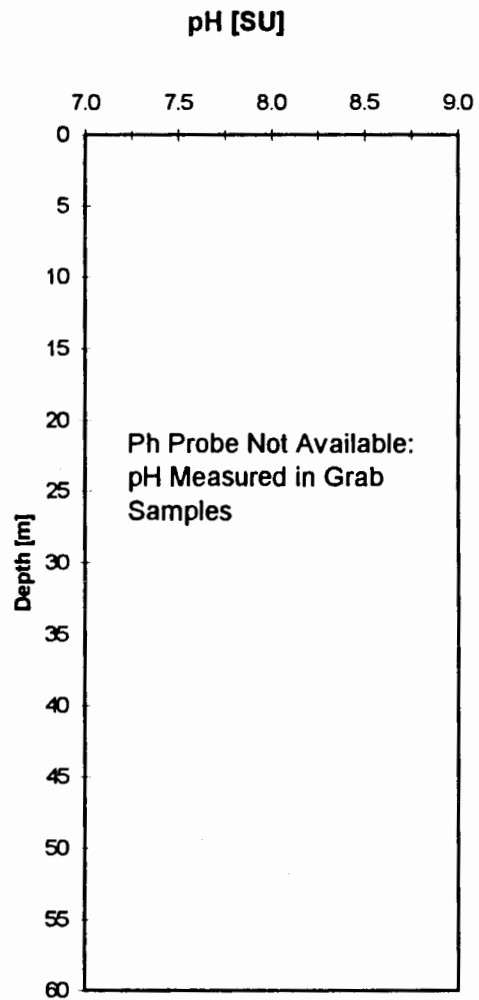
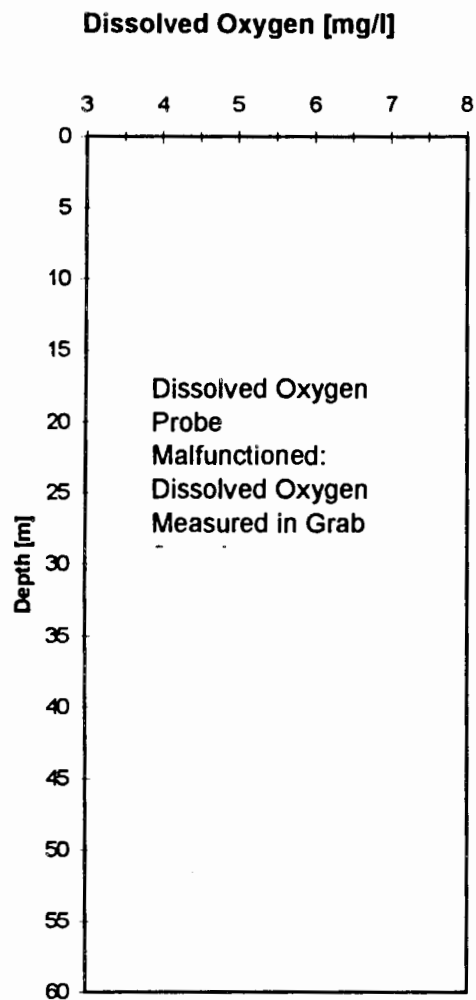
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996



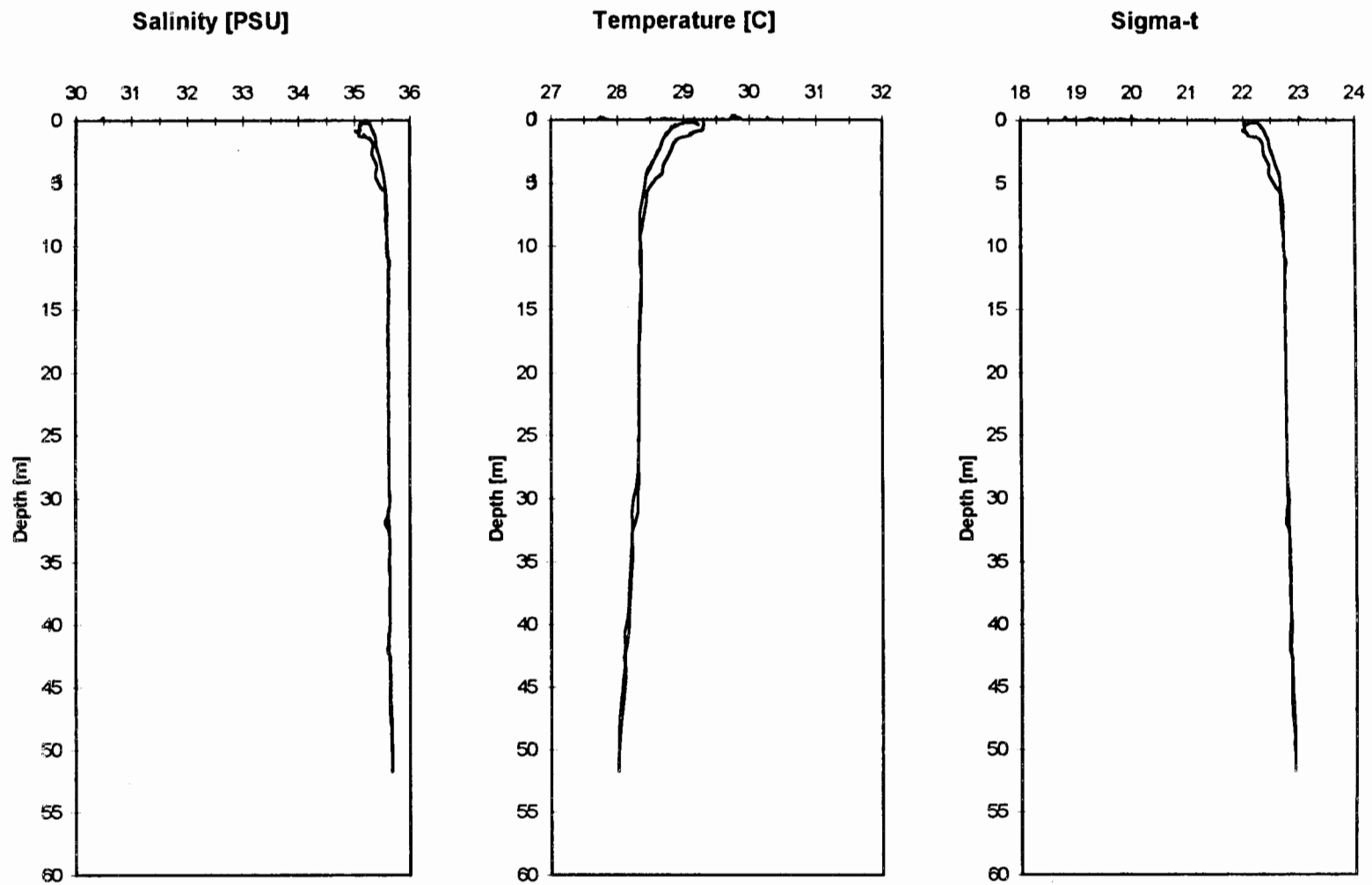
**Station 9**  
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Dissolved Oxygen, pH, and Turbidity  
23 November 1996



**Station 9A**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
**Salinity, Temperature, and Density**  
**23 November 1996**

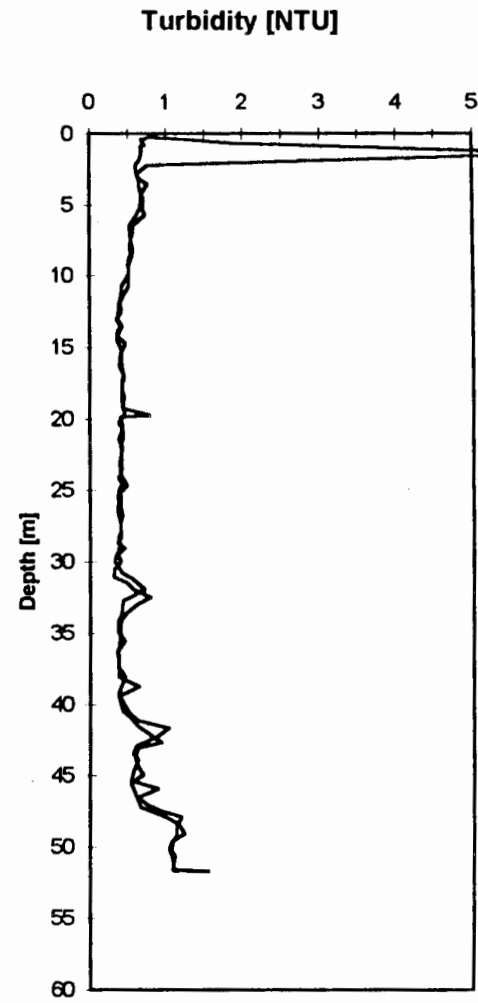
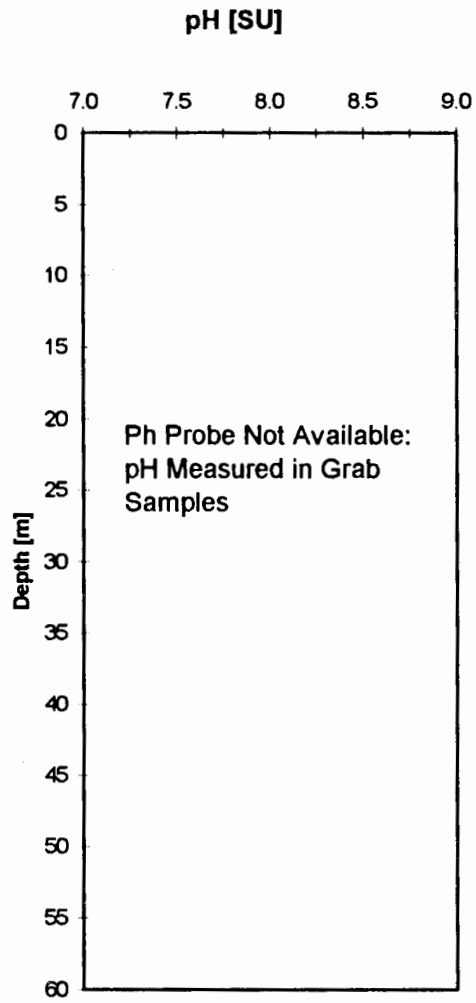
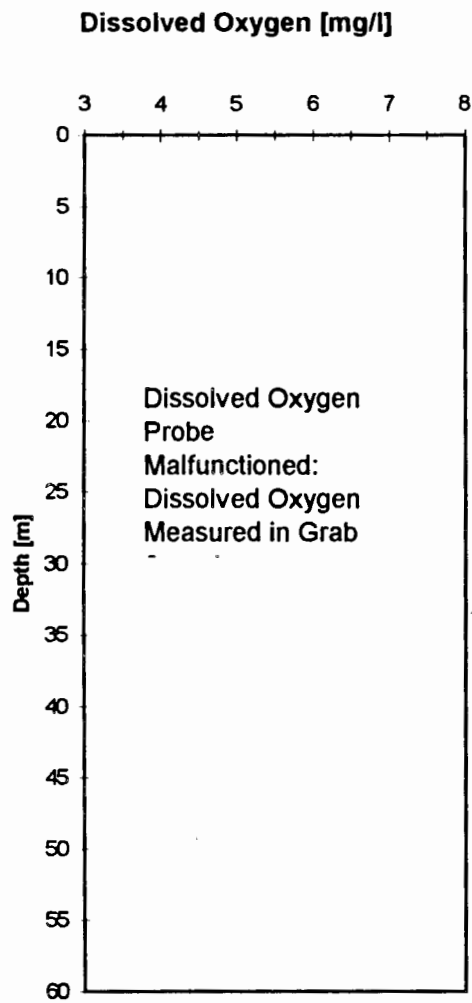


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Dissolved Oxygen, pH, and Turbidity  
23 November 1996

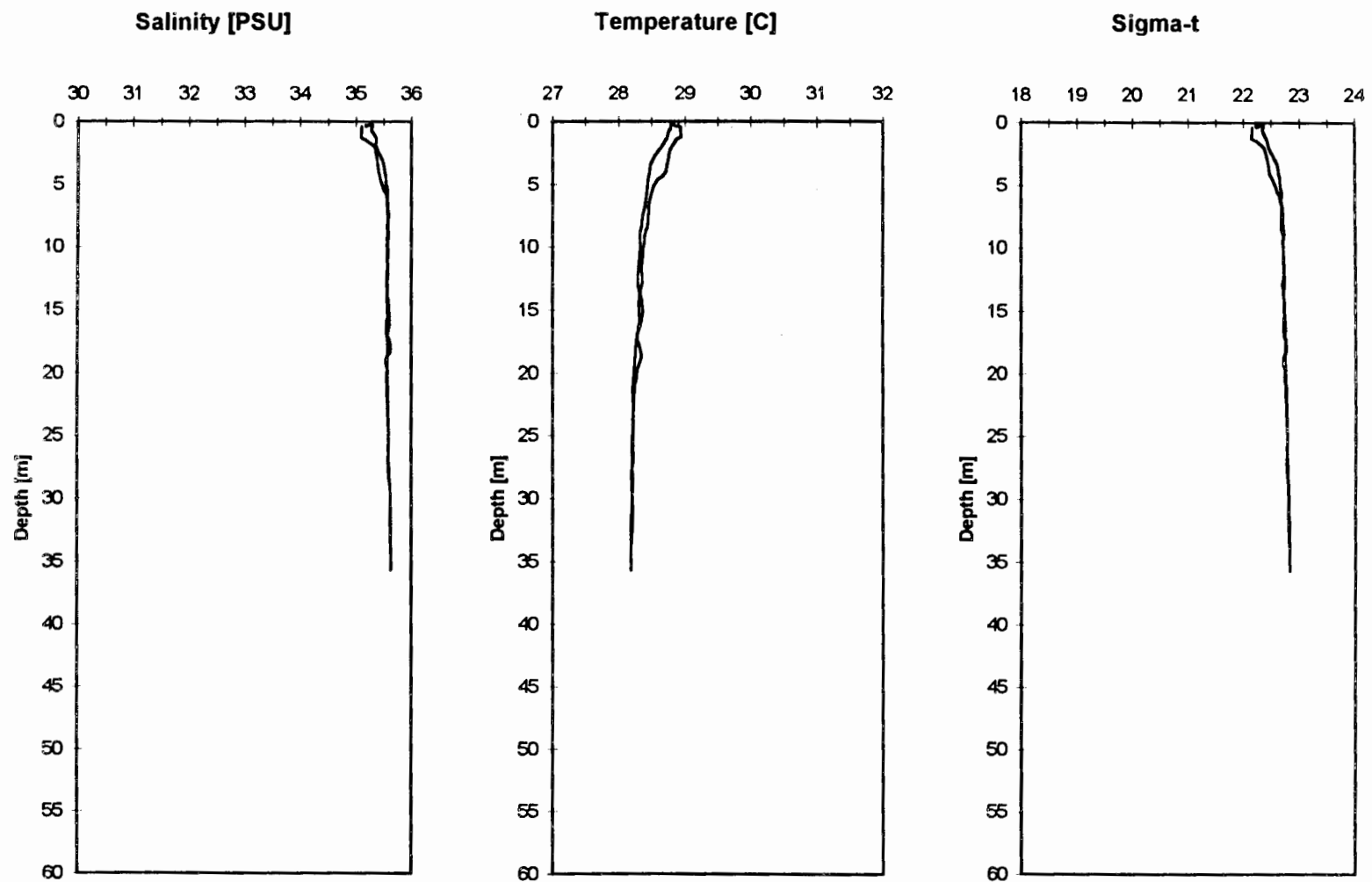


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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996

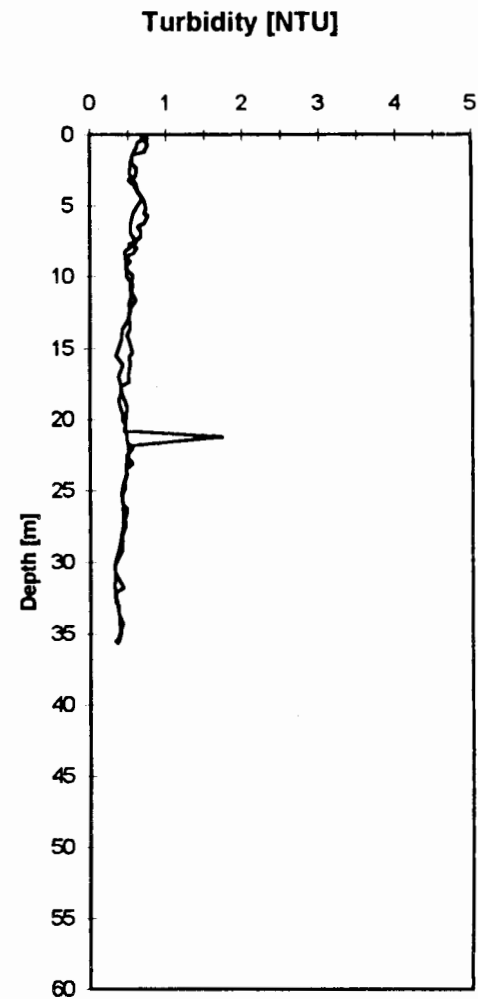
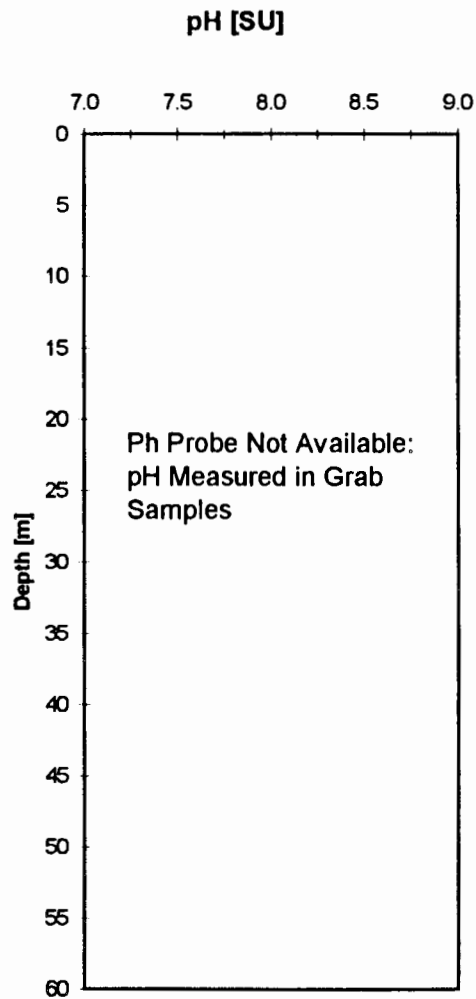
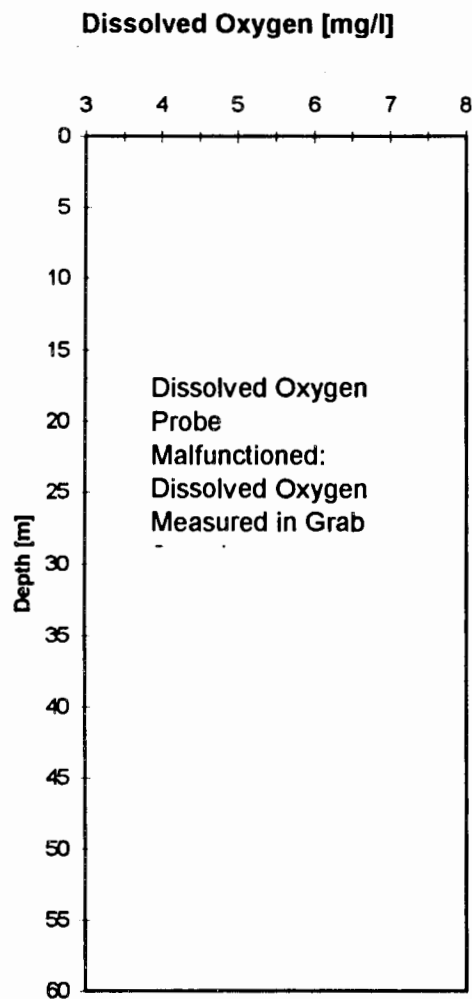




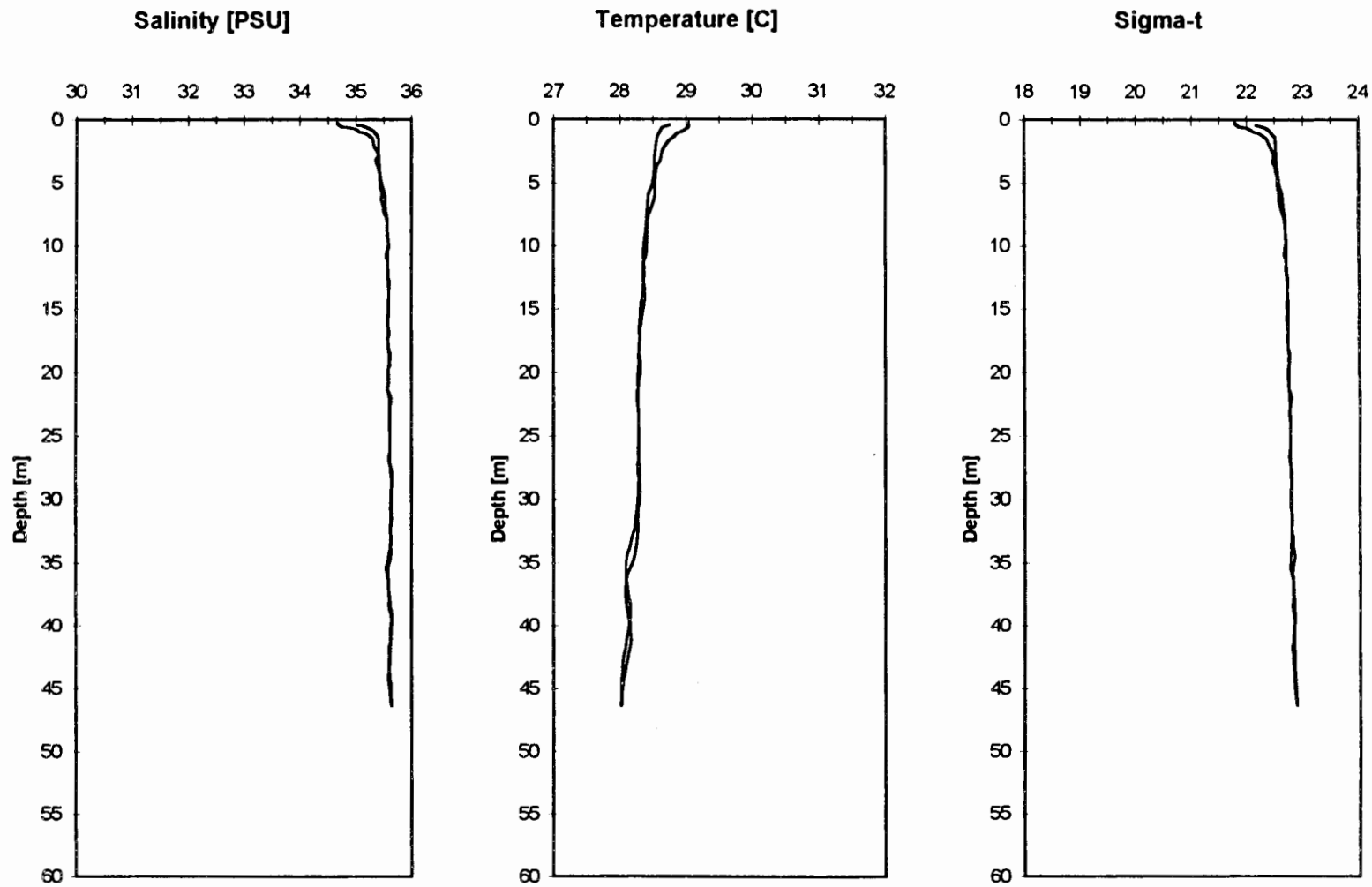
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



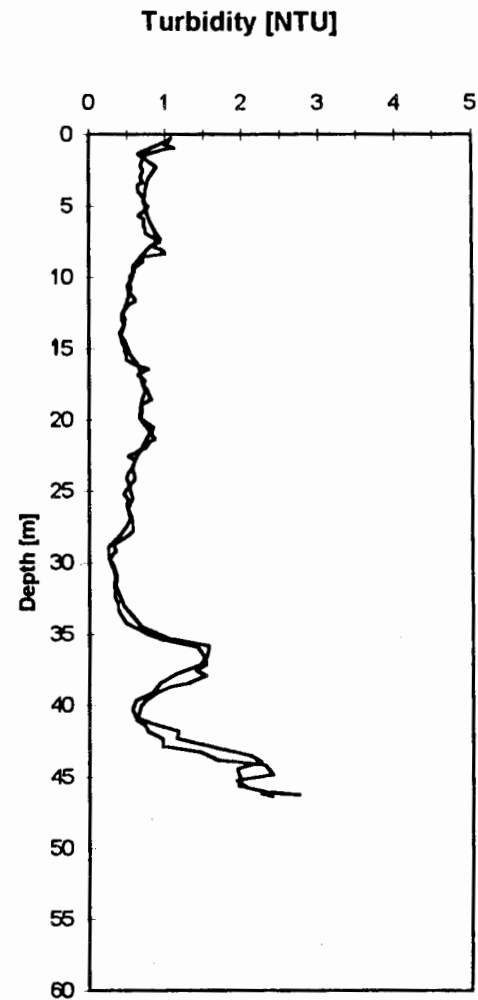
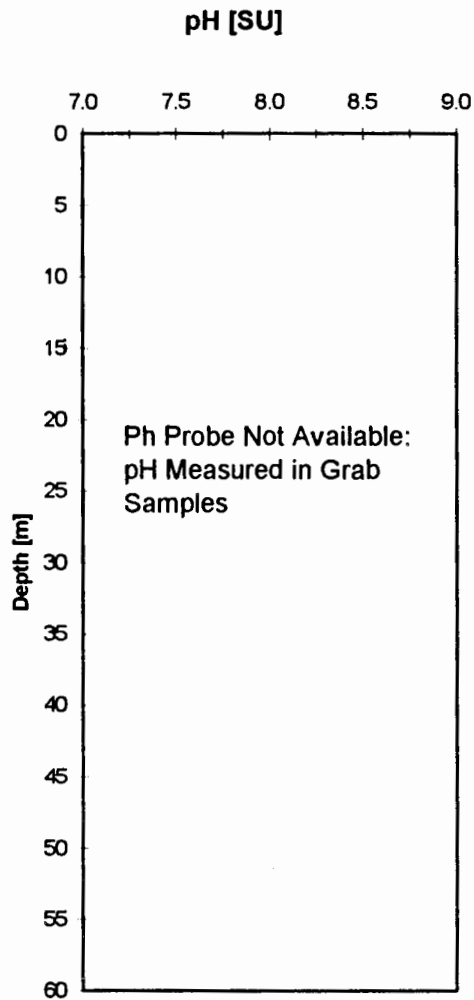
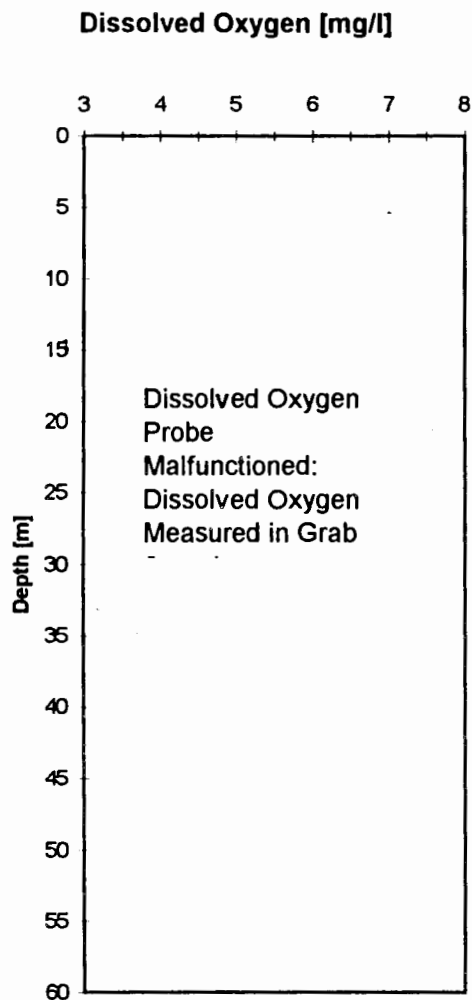
**Station 10A**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
**Salinity, Temperature, and Density**  
**23 November 1996**



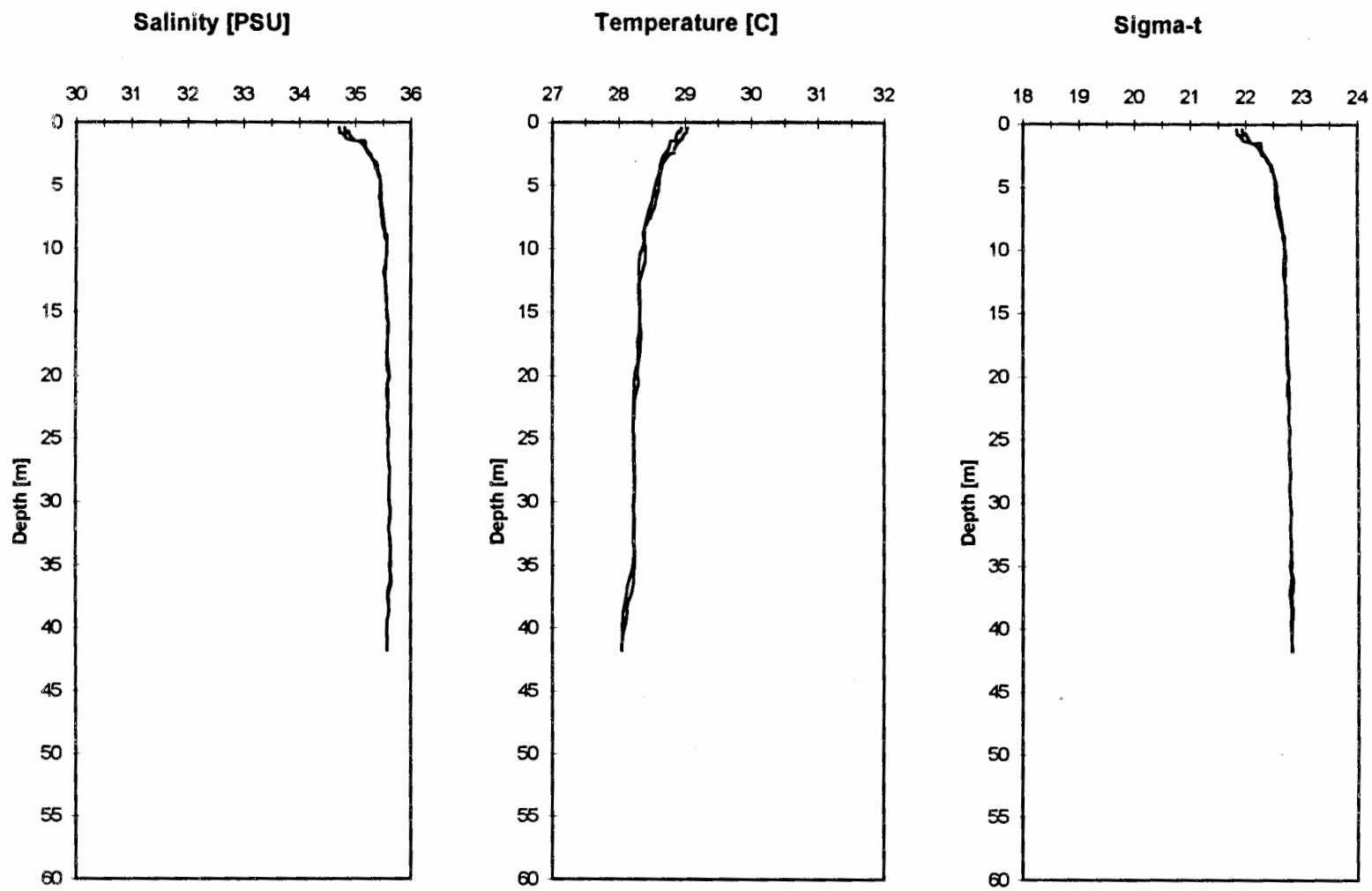
**Station 10A**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



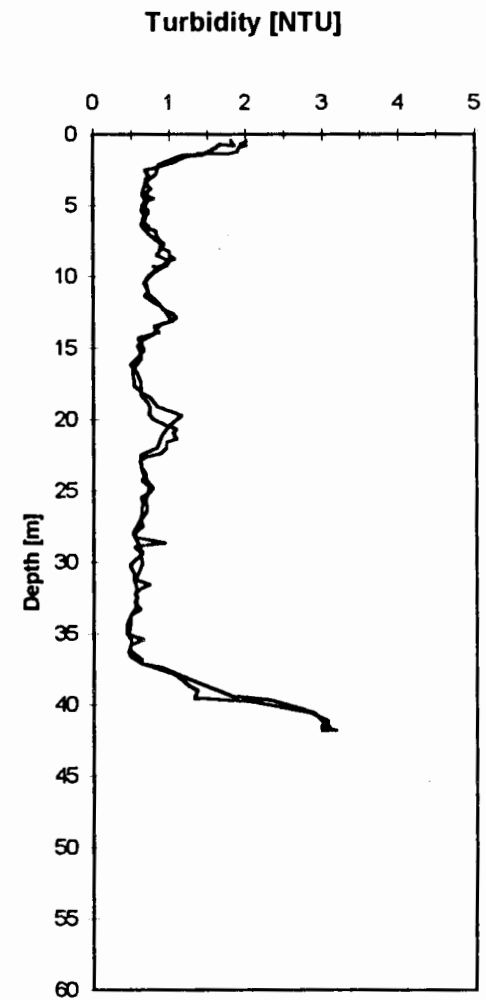
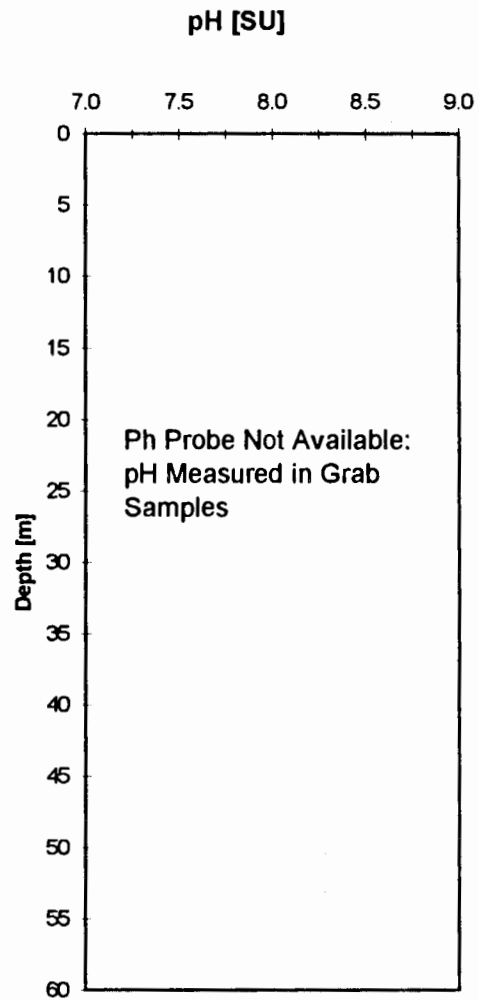
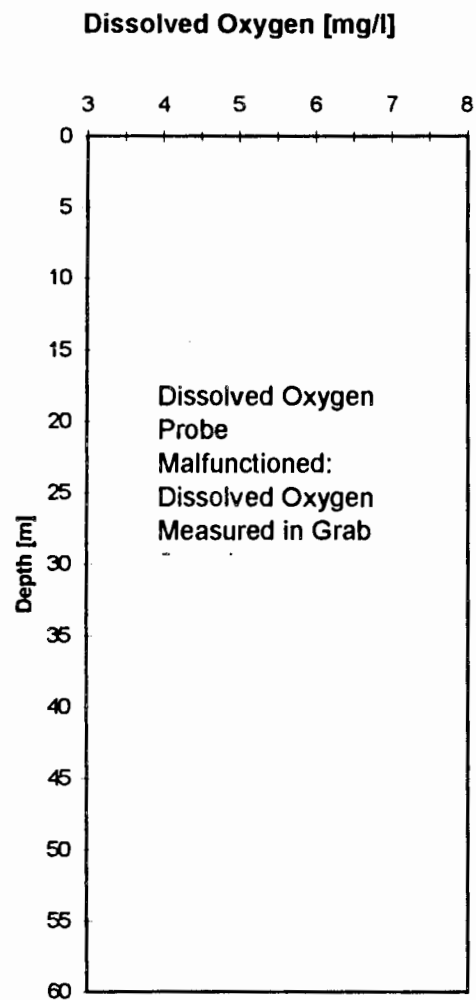
**Station 11**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996



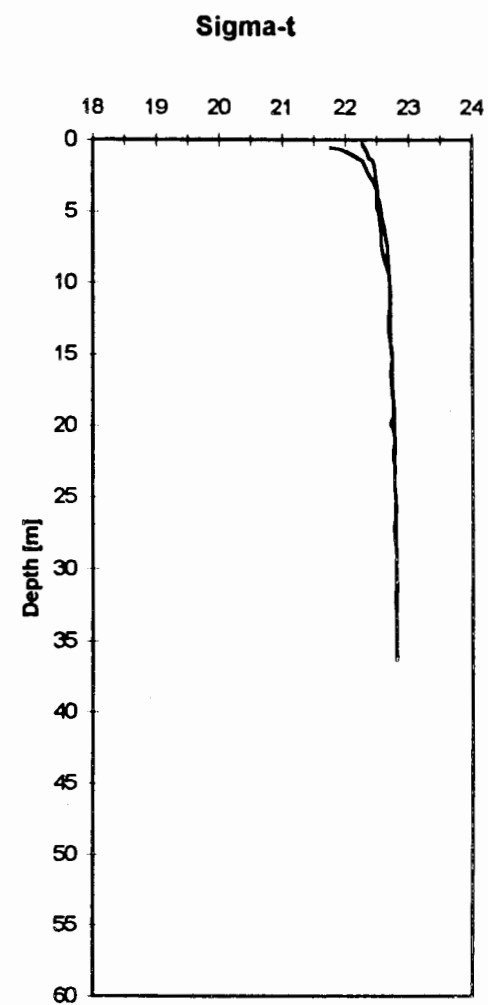
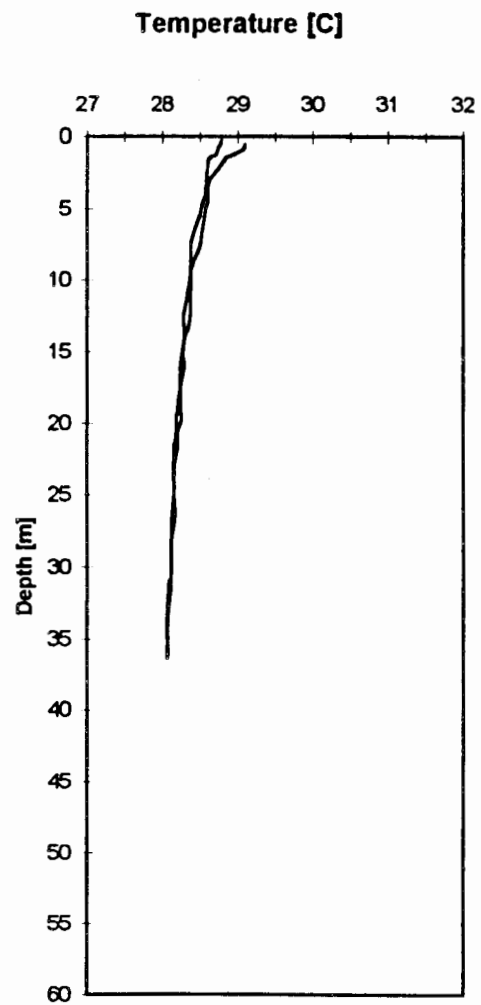
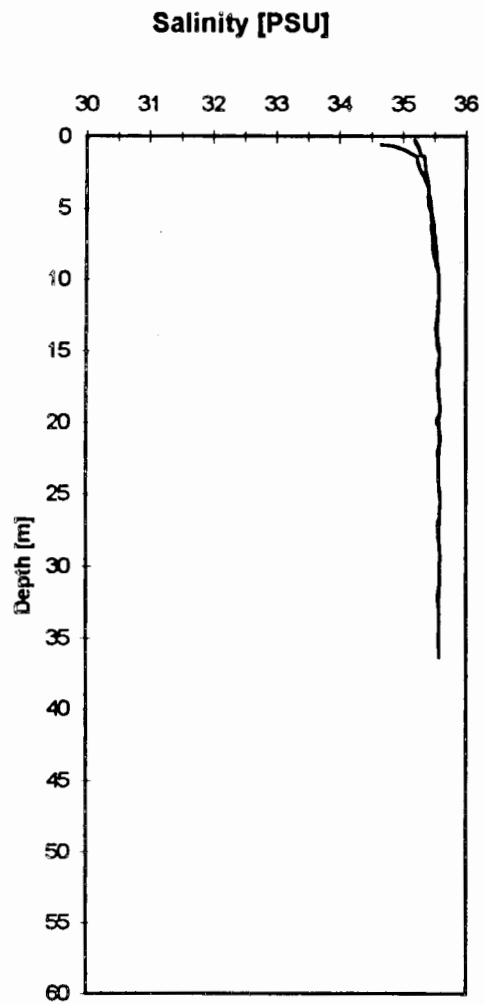
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



**Station 11A**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996

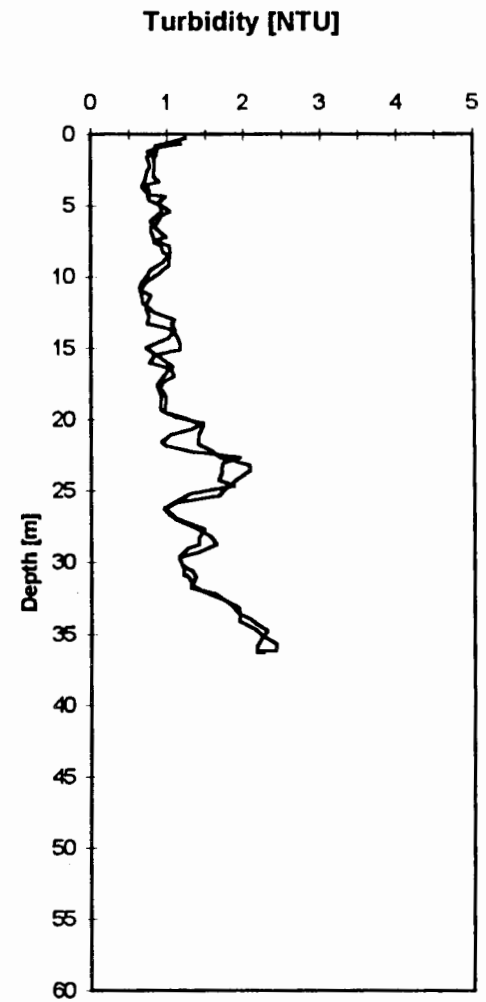
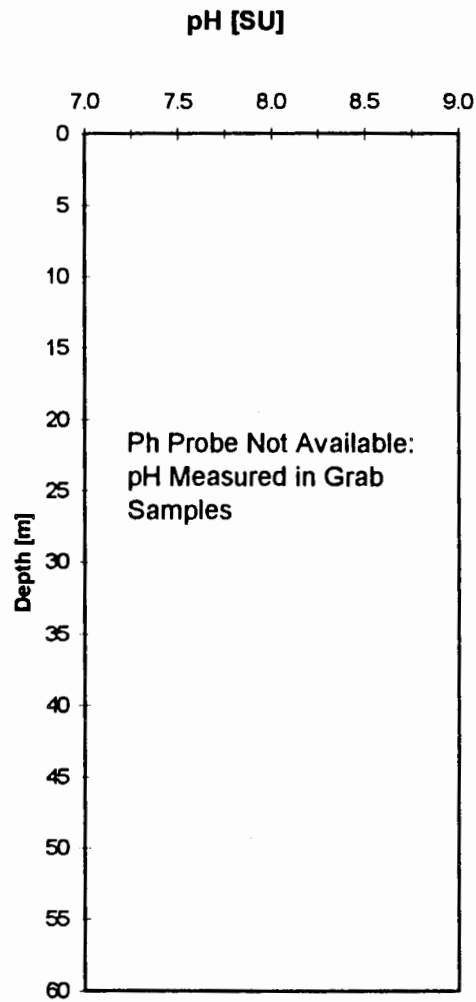
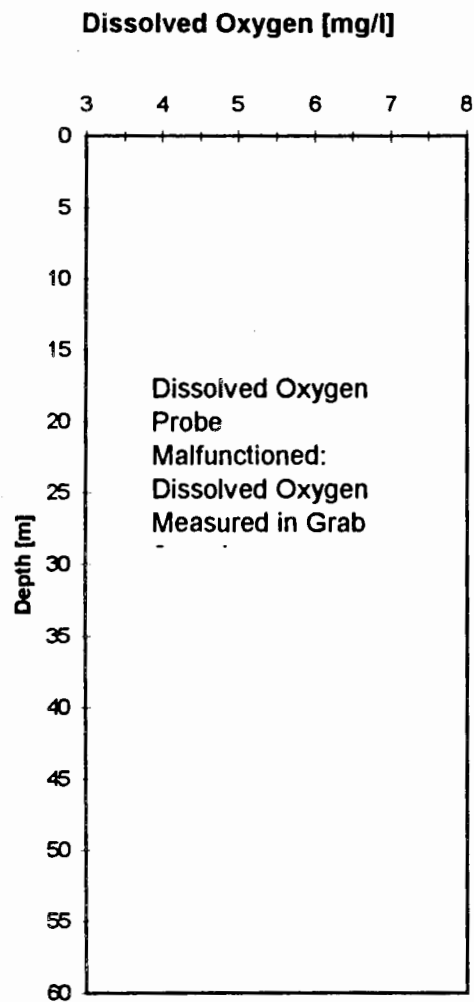


**Station 11A**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996

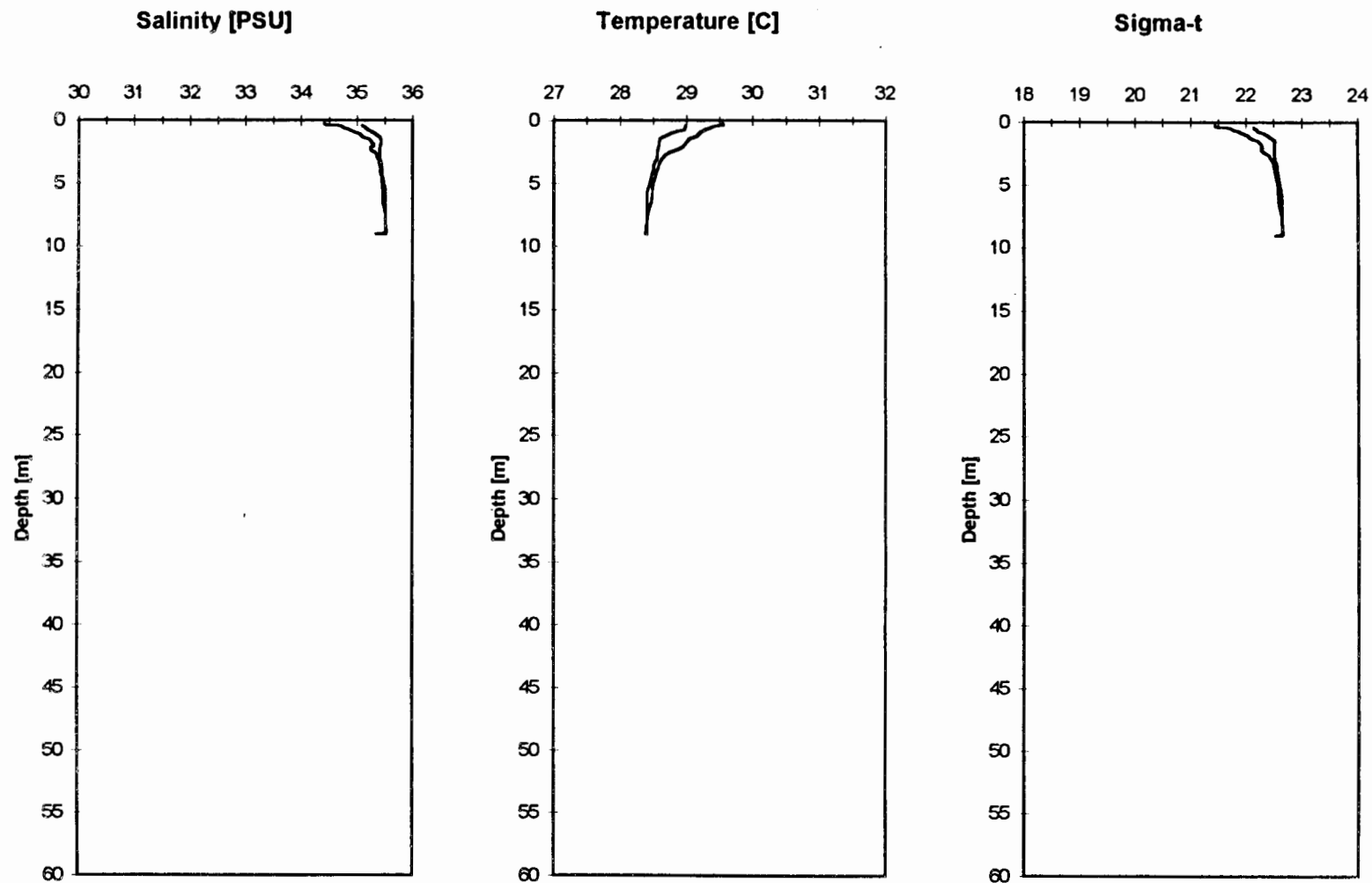


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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996

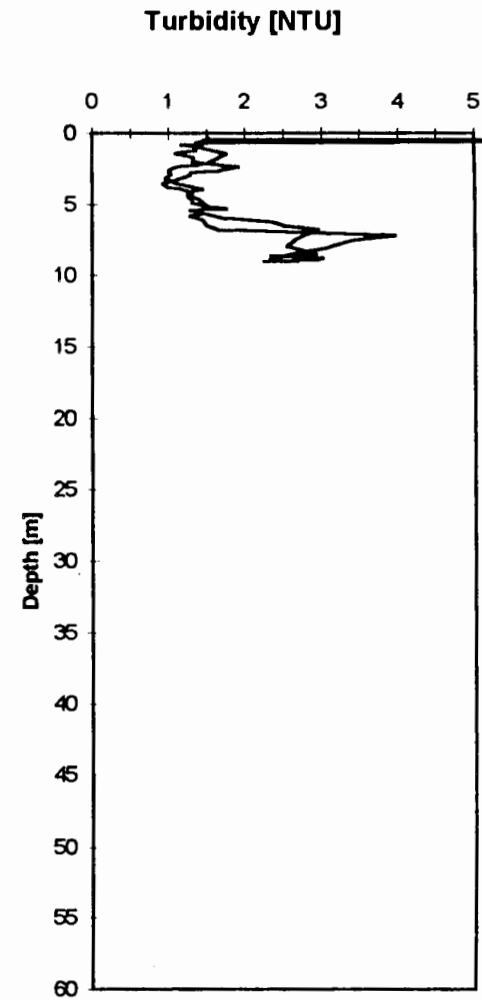
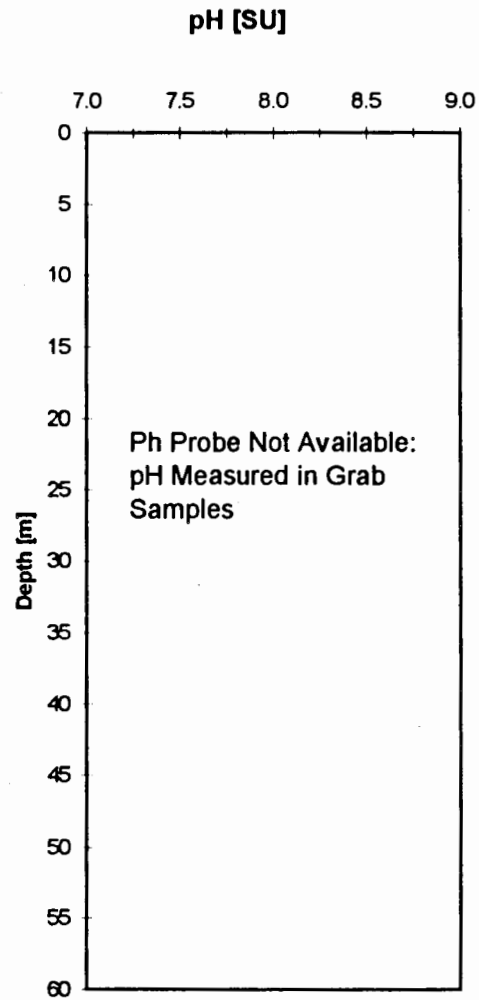
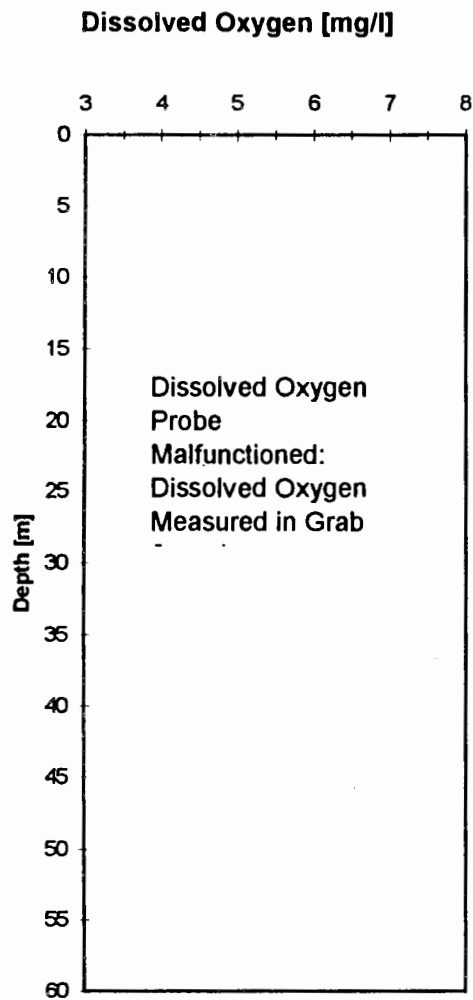




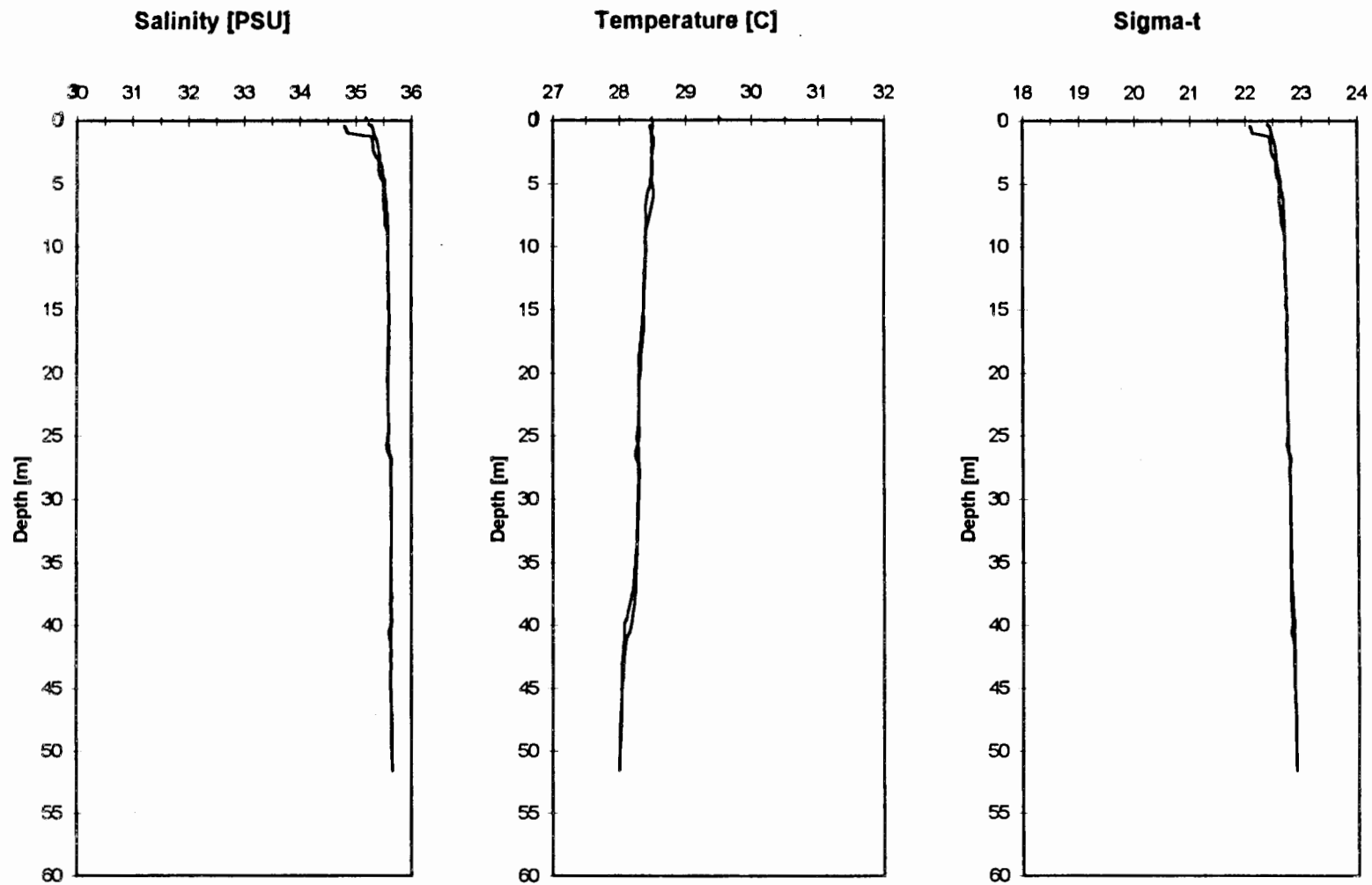
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



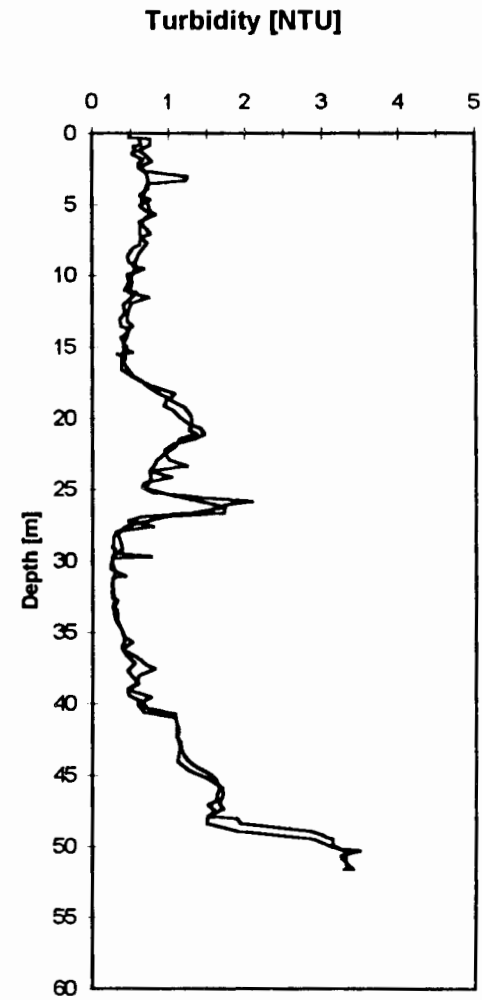
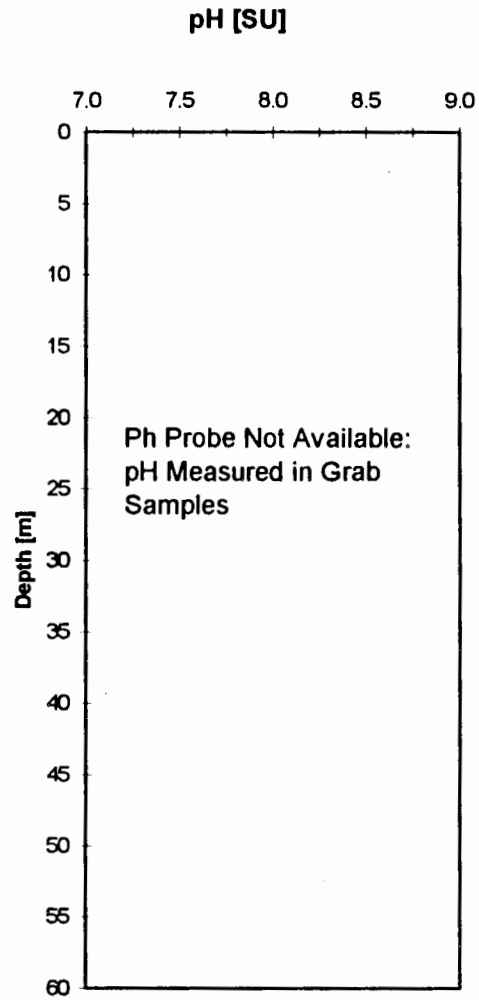
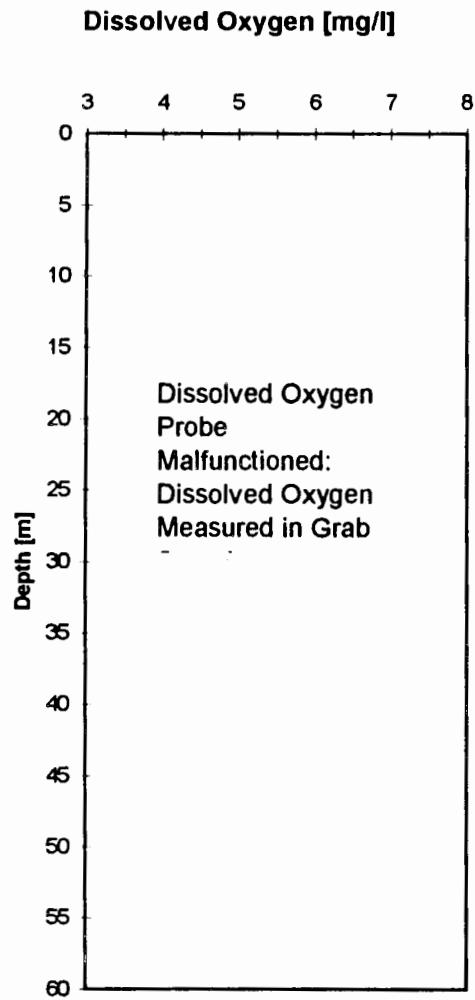
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996



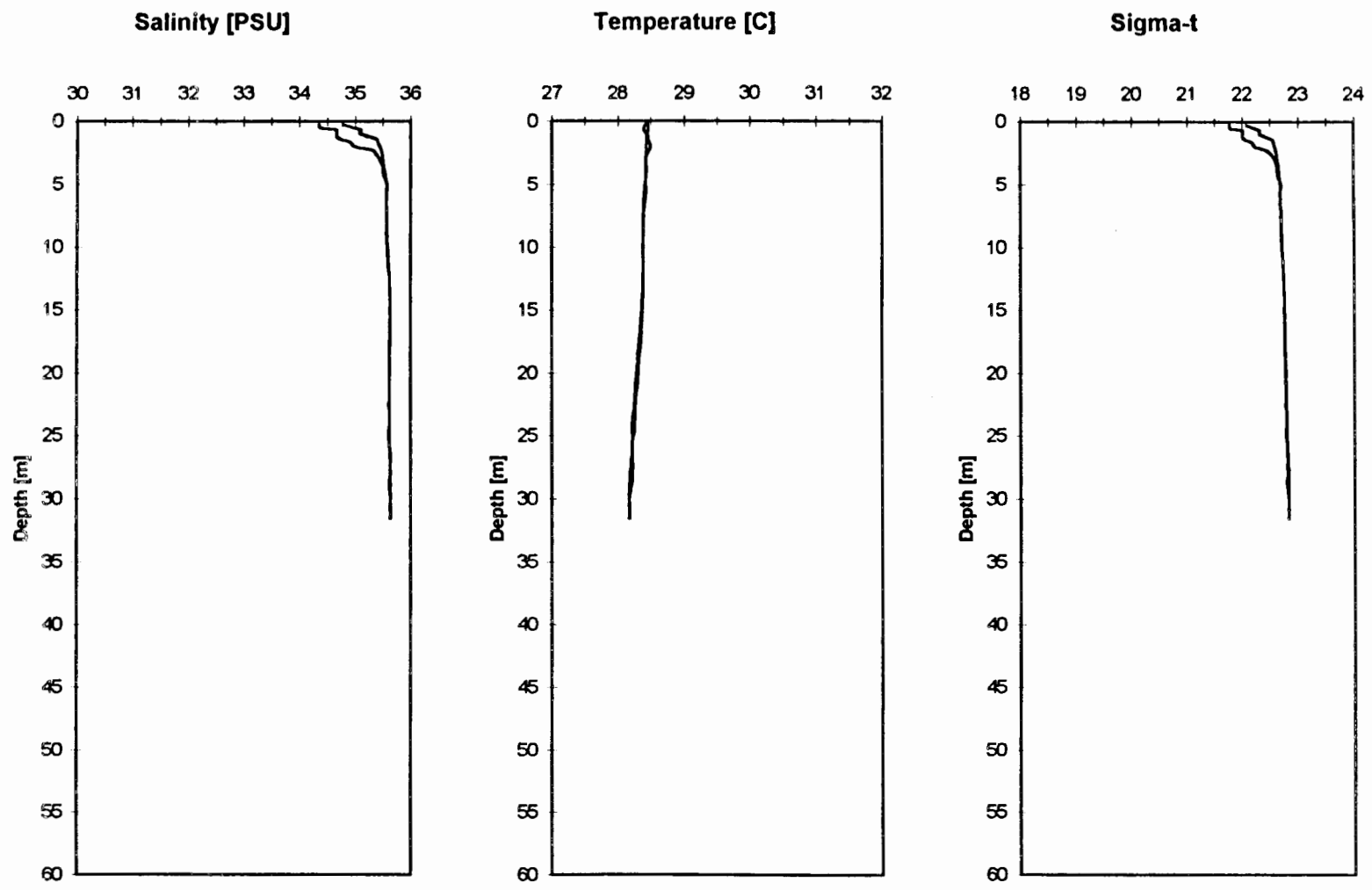
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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



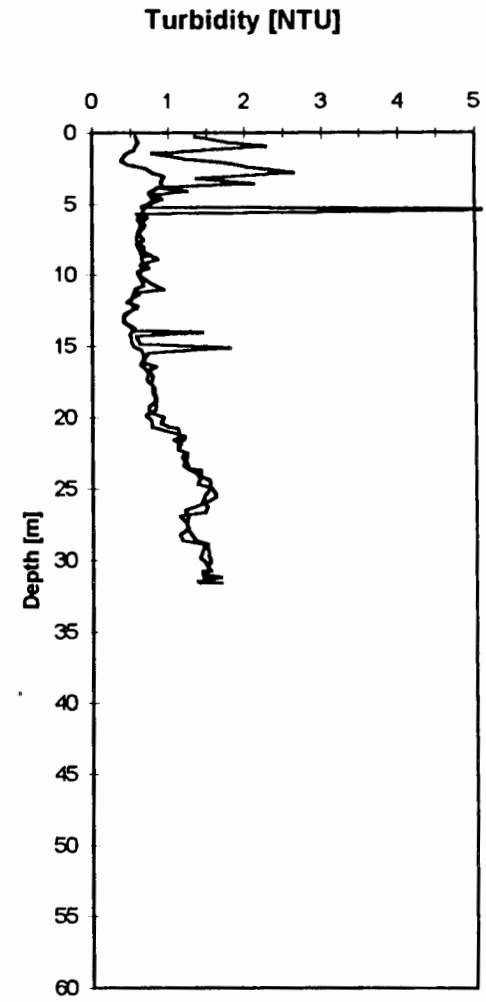
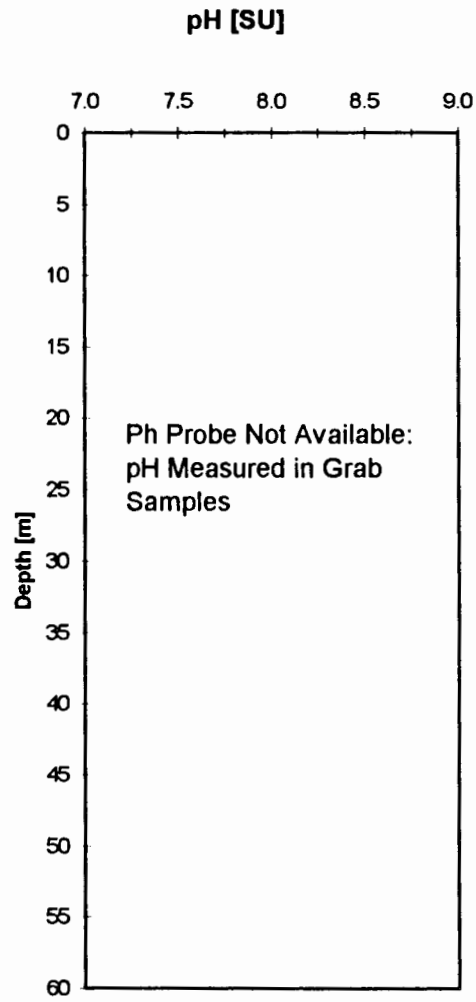
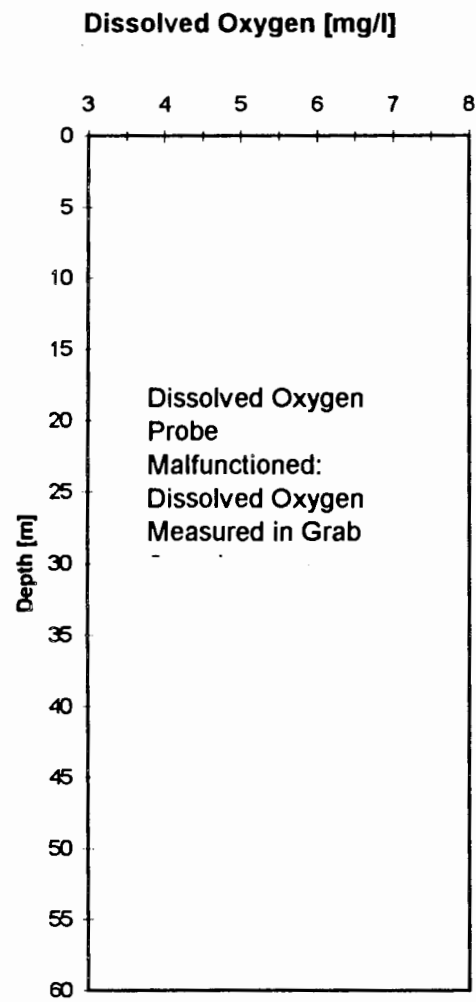
**Station 14**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996



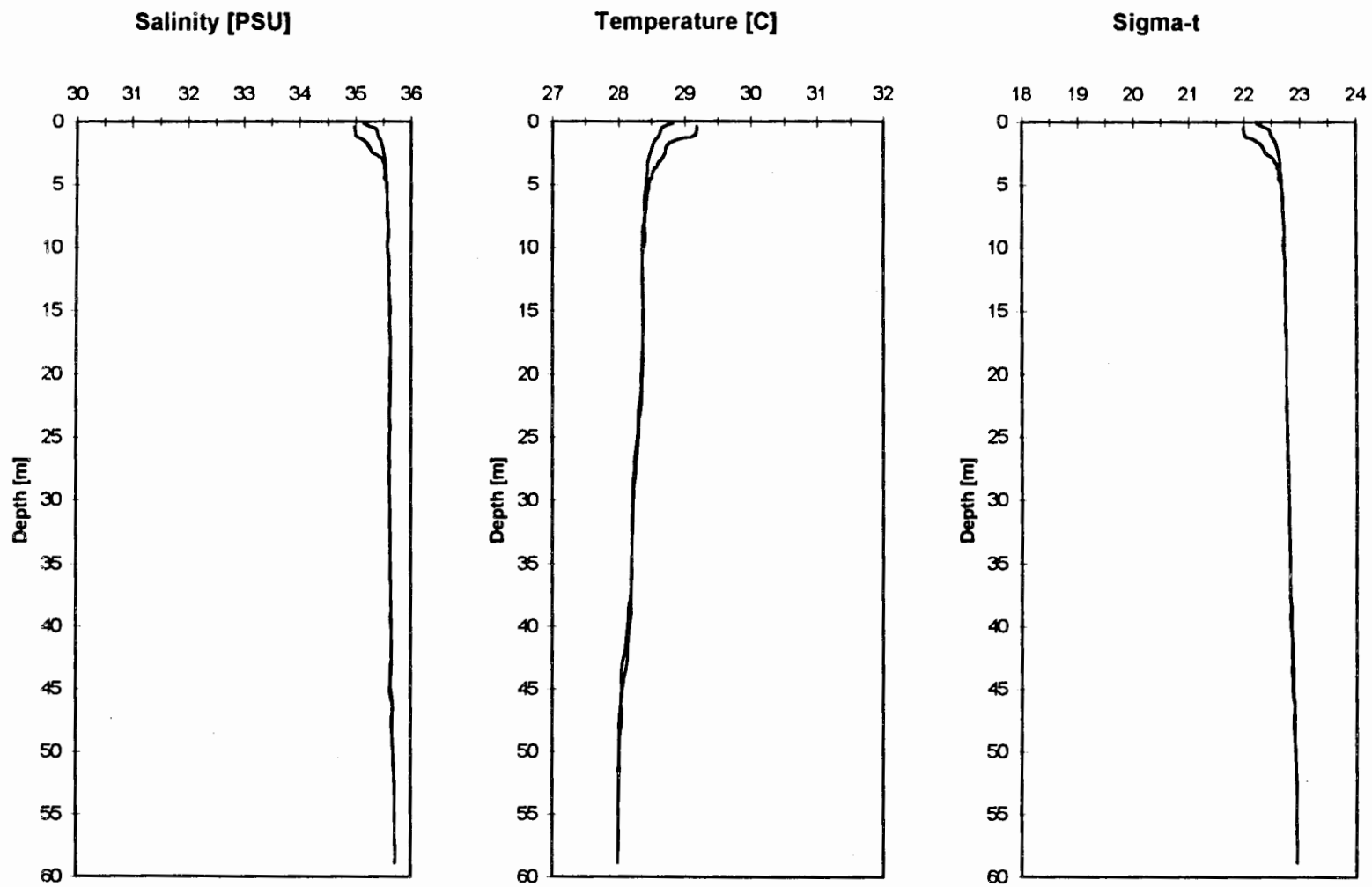
**Station 14**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



**Station 15**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996

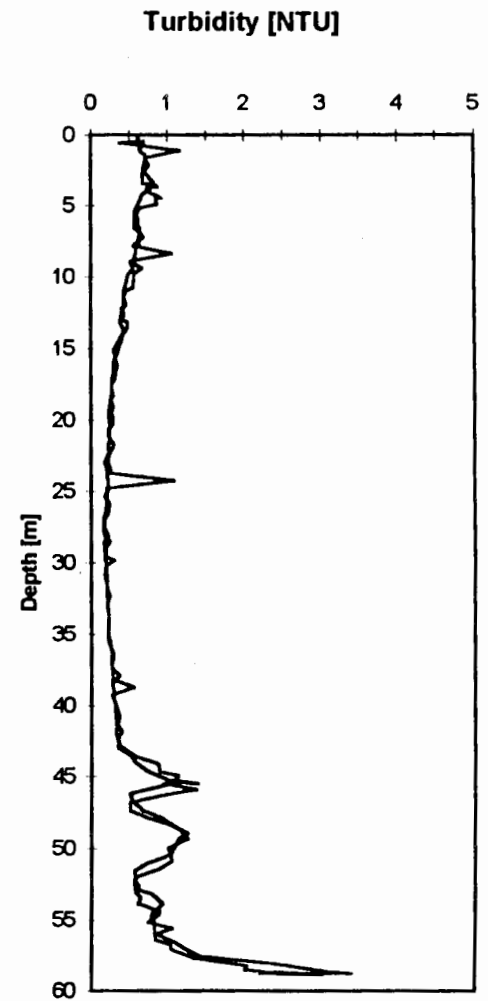
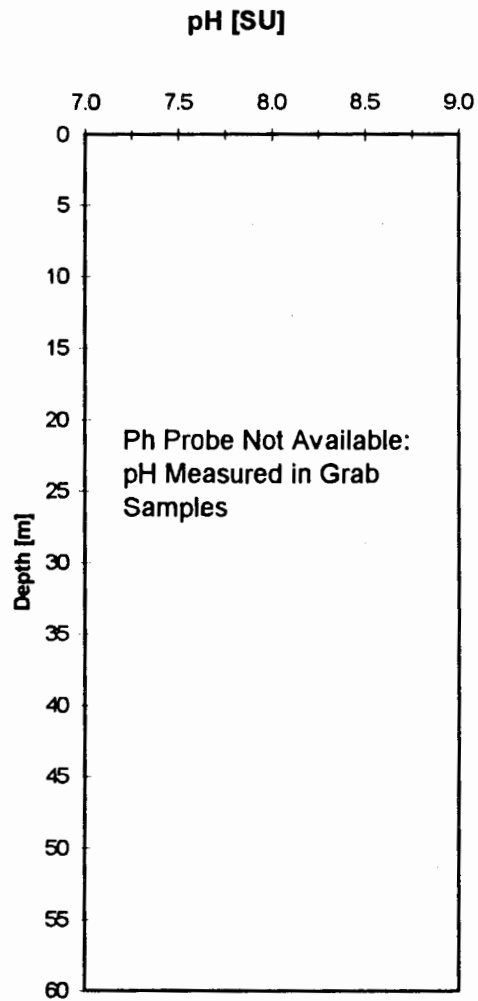
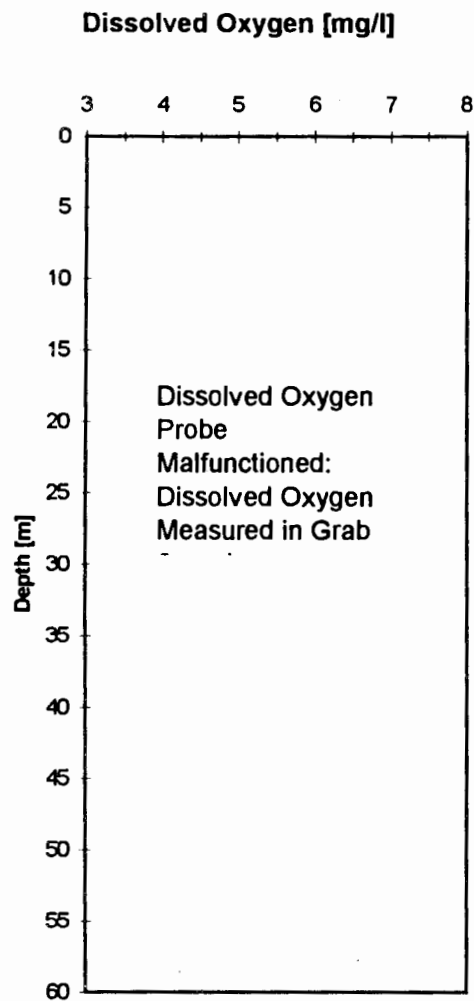


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**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996

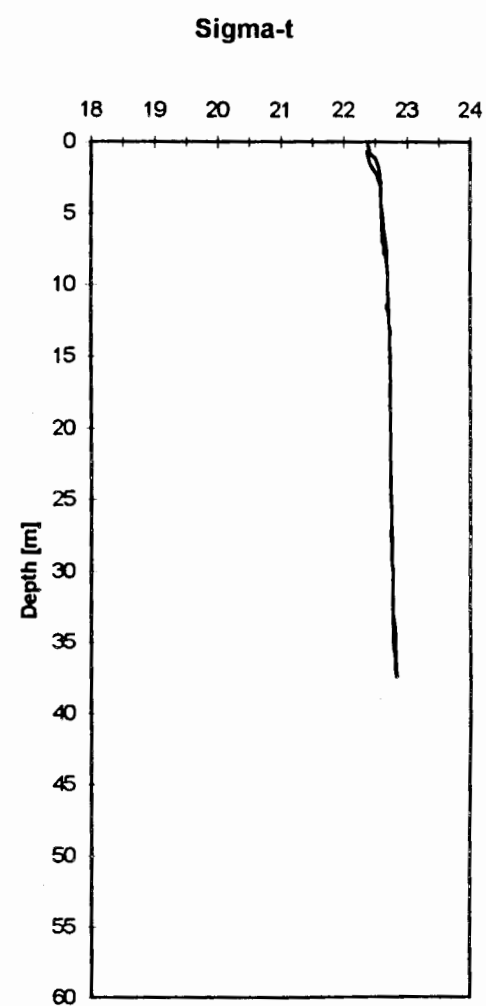
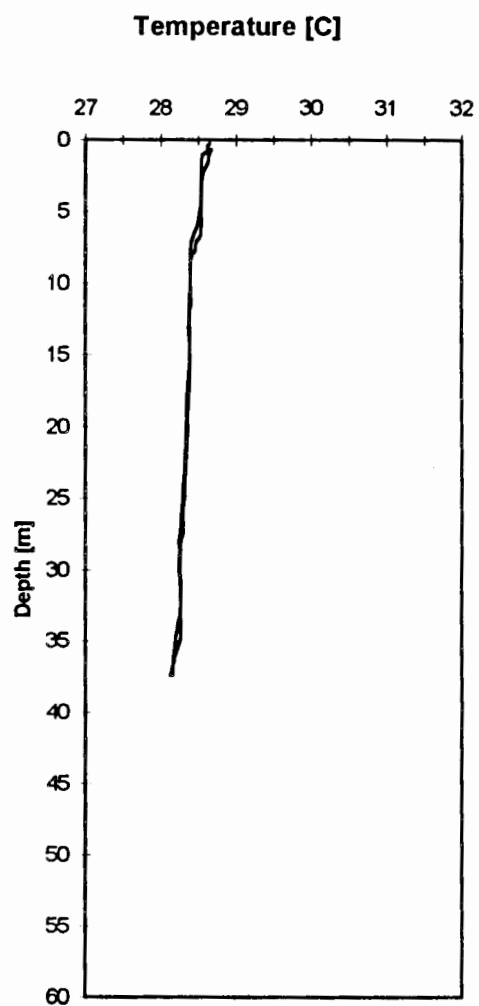
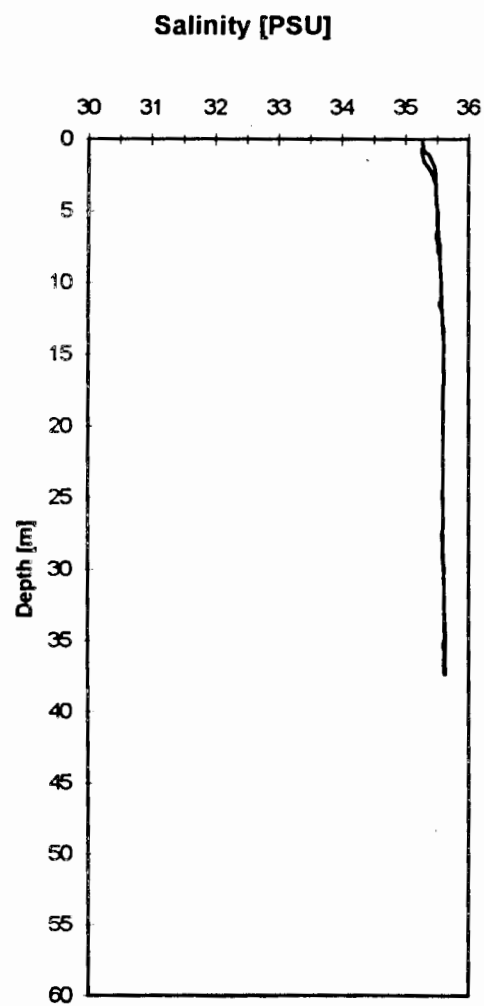


**Station 16**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996

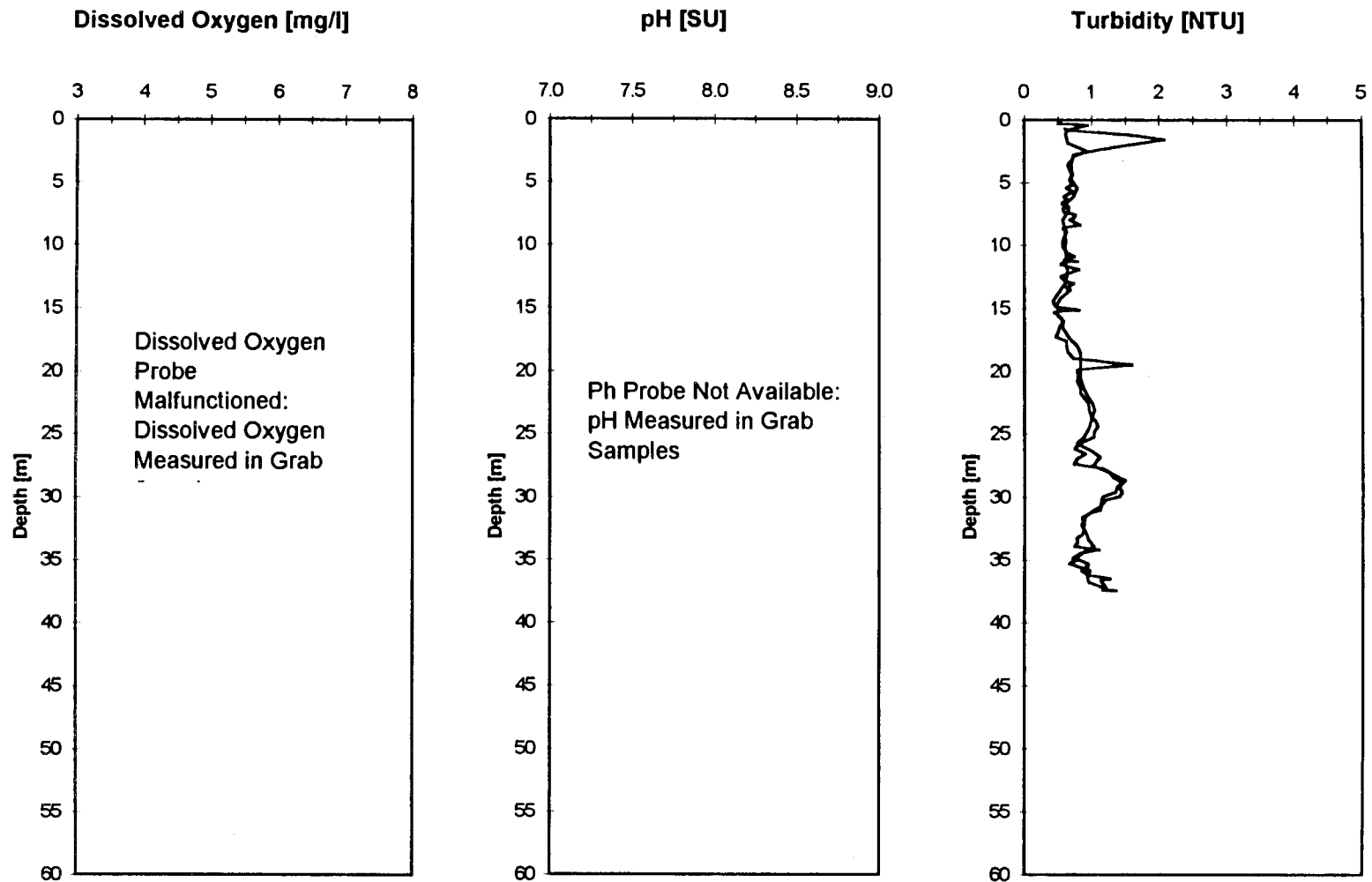




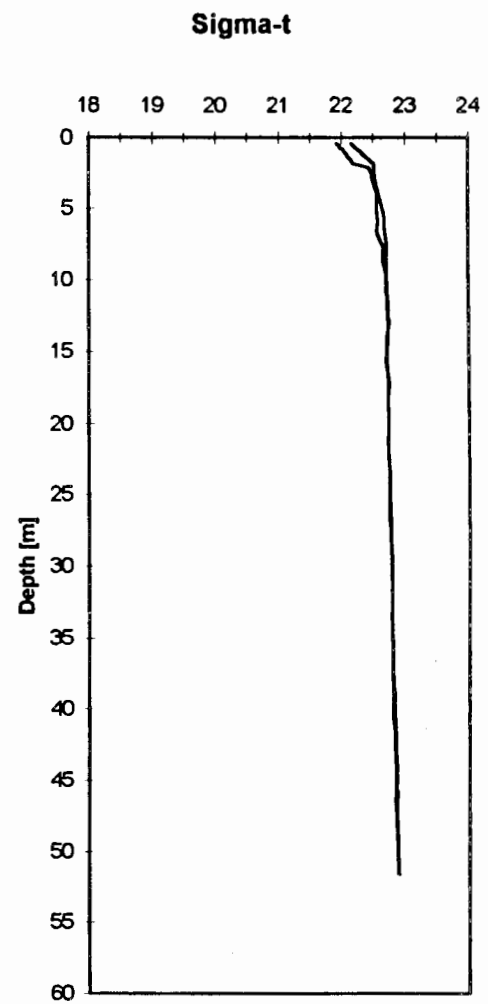
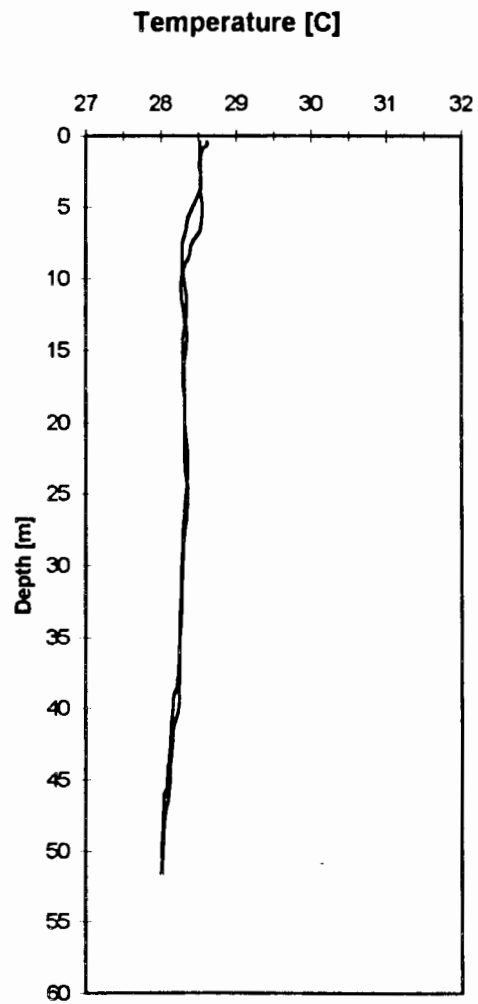
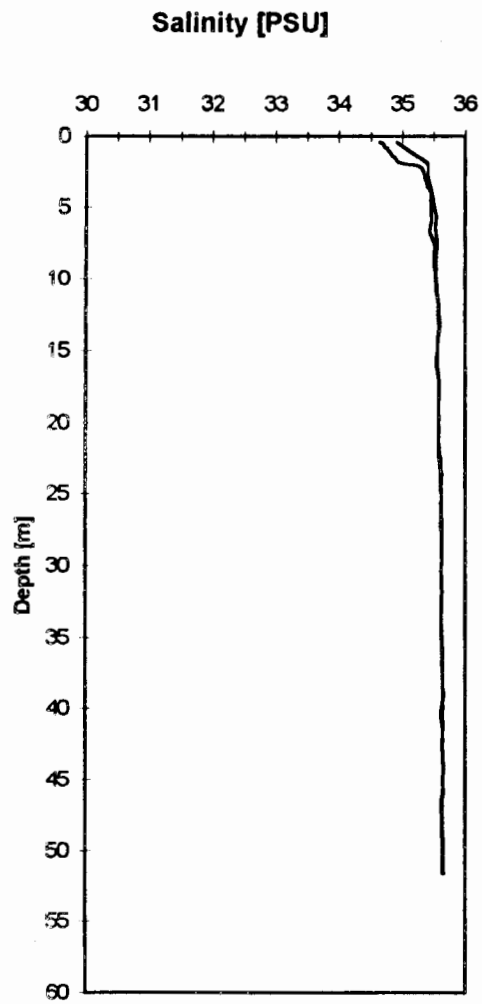
**Station 16**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



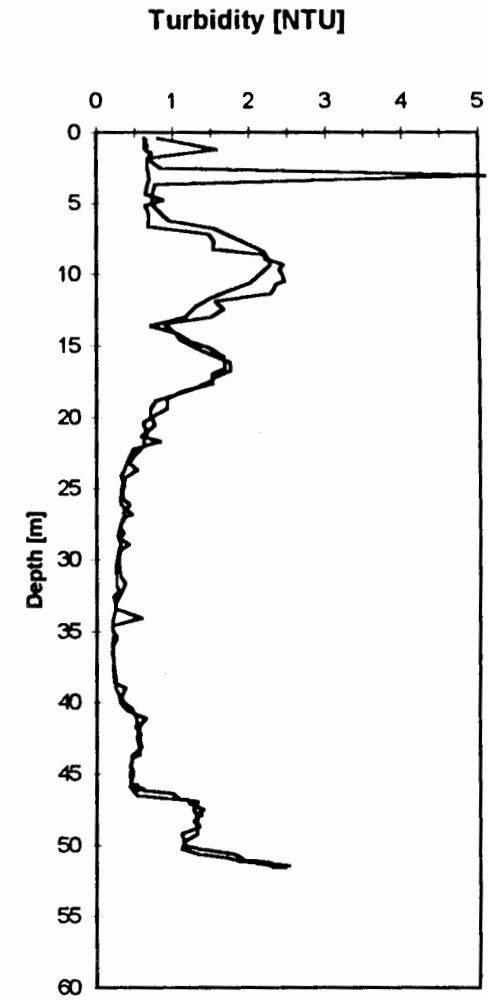
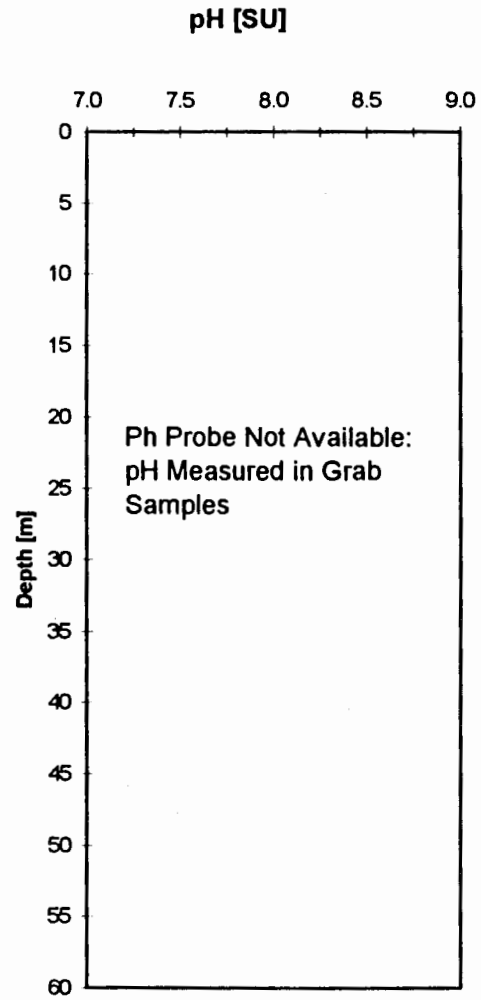
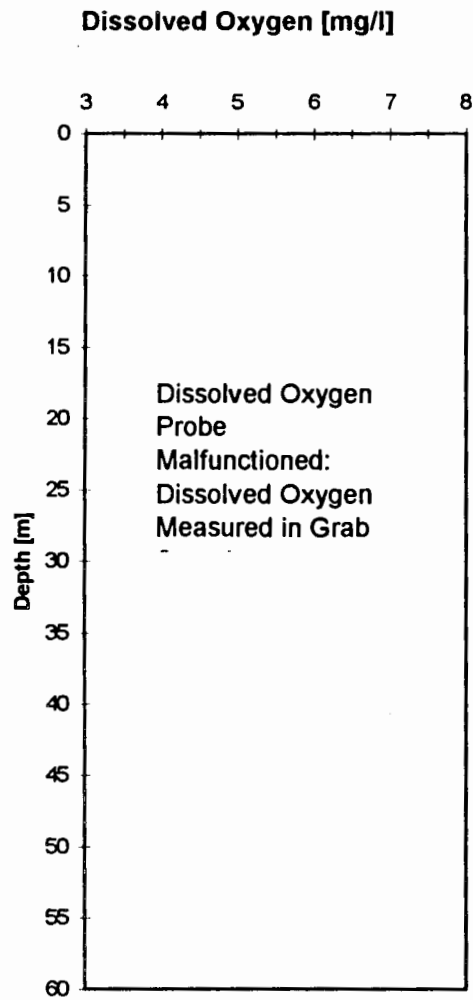
**Station 17**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996



**Station 17**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996



**Station 18**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Salinity, Temperature, and Density  
23 November 1996



**Station 18**  
**Pago Pago Harbor Water Quality Monitoring Profiles**  
Dissolved Oxygen, pH, and Turbidity  
23 November 1996

## **Appendix IV**

### **Chain of Custody Records**

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

PAGE 1 of 2

CH2M Hill Project # <b>107091.WG.96</b>		Purchase Order #		LAB TEST CODES										SHADED AREA- FOR LAB USE ONLY								
Project Name <b>JCO HARBOR MONITORING</b>				# OF CONTAINERS	ANALYSES REQUESTED <b>AMMONIA (350.1) NITRATE (353.2) NITRITE (353.2) TKN @ DL of 0.05mg/L (357.3) TOTAL PHOSPHORUS (356.2)</b>										Lab 1 #		Lab 2 #					
Company Name/CH2M Hill Office <b>CH2M HILL</b>															Quote #		Kit Request #					
Project Manager & Phone # Mr. [ ] <b>STEVE COSTA</b> Ms. [ ] Dr. [ ] <b>707-886-0717</b>															Report Copy to:				Project #			
Requested Completion Date:		Sampling Requirements SDWA <input type="checkbox"/> NPDES <input checked="" type="checkbox"/> RCRA <input type="checkbox"/> OTHER <input type="checkbox"/>													Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		No. of Samples		Page of			
Type COM P		Matrix WATER SOIL AIR													CLIENT SAMPLE ID (9 CHARACTERS)		Login		LIMS Ver			
Date	Time					REMARKS		LAB 1 ID		LAB 2 ID												
1/24/96		X		5 - BOTM	163152	X	X	X	X	X												
				5 - <del>120</del>	316																	
				5 - 90	317																	
				5 - 60	318																	
				5 - 30	319																	
				5 - SURF	320																	
				5A - BOTM	321																	
				5A - 120	322																	
				5A - 90	323																	
				5A - 60	324																	
				5A - 30	325																	
Sampled By & Time <b>SA Costa 11/96</b>				Date/Time		Relinquished By <b>SA Costa 11/23/96</b>				Date/Time		QC Level: 1 2 3 Other:										
Received By <b>M. Brown</b>				Date/Time <b>11/25/96</b>		Relinquished By				Date/Time		COC Rec ICE										
Received By				Date/Time		Relinquished By				Date/Time		Ana Req TEMP										
Received By				Date/Time		Shipped Via UPS BUS Fed-Ex Hand Other <b>DHL</b>				Shipping #		Cust Seal Ph										
Work Authorized By				Date/Time		Remarks <b>TKN @ DL of 0.05mg/L Do NOT RUN TURBIDITY ON THESE</b>																

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client  
REV 3/94 FORM 340

PAGE 2 of 2

CH2M Hill Project # <b>107091.WQ.96</b>		Purchase Order #		LAB TEST CODES										SHADED AREA - FOR LAB USE ONLY							
Project Name <b>JCO HARBOR MONITORING</b>				# OF CONTAINERS											Lab 1 #		Lab 2 #				
Company Name/CH2M HILL Office <b>CH2M HILL</b>															Quote #		Kit Request #				
Project Manager & Phone # Mr. [ ] <b>STEVE COSTA</b> Ms. [ ] Dr. [ ]					Report Copy to:										Project #						
Requested Completion Date:		Sampling Requirements SDWA NPDES RCRA OTHER <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		ANALYSES REQUESTED										No. of Samples		Page of		
																	Login		LIMS Ver		
Sampling Date Time		Type COMP GRAB	Matrix WATER SOIL AIR	CLIENT SAMPLE ID (9 CHARACTERS)												REMARKS		LAB 1 ID		LAB 2 ID	
11/16			X	5A - SURF 163262		X	X	X	X	X						SEAWATER					
				6 - BOTM 327																	
				6 - 120 328																	
				6 - 90 329																	
				6 - 60 330																	
				6 - 30 331																	
				6 - SURF 332																	
				6A - BOTM 333																	
				6A - 60 334																	
				6A - 30 335																	
				6A - SURF 336																	
Sampled By & Title <b>SACosta 11/196</b>				Date/Time		Relinquished By <b>SACosta 11/22/96</b>				Date/Time		QC Level: 1 3 Other:									
Received By <b>M. Bern</b>				Date/Time <b>11/25</b>		Relinquished By				Date/Time		COC Rec ICE									
Received By				Date/Time		Relinquished By				Date/Time		Ana Req TEMP									
Received By				Date/Time		Shipped Via UPS BUS Fed-Ex Hand Other <b>DHL</b>				Shipping #											
Work Authorized By				Remarks <b>TKN @ DL of 0.05 mg/L - NO TURBIDITY TEST ON THESE</b>																	





QAL ANALYTICAL  
LABORATORIES, INC.

# CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

1 THESE SAMPLES  
COOLER (WITH STATION'S  
11, 11A, 12, 13

Project # 107091, 10709		Purchase Order #		<input type="checkbox"/> LGN One Innovation Drive, Suite C Alachua, FL 32615-9586 (904) 462-3050 FAX (904) 462-1670		<input type="checkbox"/> LRD 5090 Caterpillar Road Redding, CA 96003-1412 (916) 244-5227 FAX (916) 244-4109		THIS AREA FOR LAB USE ONLY				
Project Name JCO HARBOR MONITORING				<input type="checkbox"/> LMG 2567 Fairlane Drive Montgomery, AL 36116-1622 (334) 271-2440 FAX (334) 271-3428		<input type="checkbox"/> LKW Canviro Analytical Laboratories, Inc. 50 Bathurst, Unit 12 Waterloo, Ontario, Canada N2V 2C5 (519) 747-2575 FAX (519) 747-3806		Lab #	Page	of		
Company Name CH2M HILL								Client Service		Price Source A P Q S		
Project Manager or Contact & Phone # STEVE COSTA 707-826-7662				Report Copy to:				Acct Code		Test Group		
Requested Completion Date:		Site ID		Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>				Project Code		Ack. Gen.		
Sampling		Type	Matrix	CLIENT SAMPLE ID (9 CHARACTERS)		QC ID (3 CHAR)		LIMS Ver		Login	Mult.	
Date	Time	COMP	GRAB	WATER	SOIL			COC Review				
								SAMPLE REMARKS		LAB 1 ID	LAB 2 ID	
11/9/96			X	7-BOTTOM	16337	2	X	X	X	X	SEAWATER	
				7-90	333							
				7-60	339							
				7-30	340							
				7-SURF	341							
Sampled By & Title SACCO				Date/Time 11/9/96		Relinquished By SACCO				Date/Time 11/22/96		HAZWRAP/NESSA: Y N
Received By M. Brown				Date/Time 11/25		Relinquished By				Date/Time		EDATA: Y N
Received By				Date/Time		Relinquished By				Date/Time		QC LEVEL 1 2 3 OTHER
Received By				Date/Time		Shipped Via UPS Fed-Ex Other DTL				Shipping #		pH
Batch Remarks												Ice
												Custody Seal
												Temp

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client  
REV 5/95 LAB FORM 340

**CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES**

Page 2 of 2

Project # <b>107091-WQ.96</b>		Purchase Order #		<input type="checkbox"/> <b>LGN</b> One Innovation Drive, Suite C Alachua, FL 32615-9586 (904) 462-3050 FAX (904) 462-1670		<input type="checkbox"/> <b>LRD</b> 5090 Caterpillar Road Redding, CA 96003-1412 (916) 244-5227 FAX (916) 244-4109		<b>THIS AREA FOR LAB USE ONLY</b>					
Project Name <b>JCO HARBOR MONITORING</b>				<input type="checkbox"/> <b>LMG</b> 2567 Fairlane Drive Montgomery, AL 36116-1622 (334) 271-2440 FAX (334) 271-3428		<input type="checkbox"/> <b>LKW</b> Canviro Analytical Laboratories, Inc. 50 Bathurst, Unit 12 Waterloo, Ontario, Canada N2V 2C5 (519) 747-2575 FAX (519) 747-3806		Lab #	Page	of			
Company Name <b>CH2M HILL</b>								Client Service		Price Source <b>A P Q S</b>			
Project Manager or Contact & Phone # <b>STEVE COSTA 707-862-0717</b>				Report Copy to:				Acct Code		Test Group			
Requested Completion Date:		Site ID		Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>				Project Code		Ack. Gen.			
Sampling Date Time		Type Matrix COMP GRAB WATER SOIL		CLIENT SAMPLE ID (9 CHARACTERS)		QC ID (3 CHAR)		ANALYSES REQUESTED # OF CONTAINERS AMMONIA (350.1) NITRATE (353.2) NITRITE (353.2) TKN 351.3 BOD 0.05 mg/l TURBIDITY (80.1) TOTAL PHOSPHORUS (356.2)		LIMS Ver	Login	Mult.	
										COC Review			
								SAMPLE REMARKS		LAB 1 ID	LAB 2 ID		
11/46		X		8-BOT.M		16312		2 X		SEA WATER			
21				8-120		343							
				8-90		344							
				8-60		345							
				8-30		346							
				8-SURF		347							
				8A-BOTM		348							
				8A-120		349							
				8A-90		350							
				8A-60		351							
				8A-30		352							
Sampled By & Title <b>S. Costa</b>				Date/Time <b>11/19/96</b>		Relinquished By <b>S. Costa</b>				Date/Time <b>11/22/96</b>		HAZWRAP/NESSA: Y N	
Received By <b>M. Brown</b>				Date/Time <b>11/25/96</b>		Relinquished By				Date/Time		EDATA: Y N	
Received By				Date/Time		Relinquished By				Date/Time		QC LEVEL 1 2 3 OTHER	
Received By				Date/Time		Shipped Via UPS Fed-Ex Other <b>DHL</b>				Shipping #		pH Ice	
												Custody Seal Temp	
Batch Remarks: <b>TKN@ DL of 0.05 mg/l</b>													

PAGE 2 of 2

CH2M Hill Project # 107091- <del>EL-609</del>		Purchase Order #		LAB TEST CODES										SHADED AREA - FOR LAB USE ONLY				
Project Name JCO HARBOR MONITORING				# OF CONTAINERS	ANALYSES REQUESTED AMMONIA (350.1) NITRATE (353.2) NITRITE (353.2) TKH @ DL of 0.05 mg/L (351.3) TOTAL PHOSPHORUS (350.2)										Lab 1 #	Lab 2 #		
Company Name/CH2M HILL Office CH2M HILL															Quote #	Kit Request #		
Project Manager & Phone # Mr. [ ] STEVE COSTA Ms. [ ] 707-826-0717 Dr. [ ]															Report Copy to:		Project #	
Requested Completion Date:		Sampling Requirements SDWA <input type="checkbox"/> NPDES <input checked="" type="checkbox"/> RCRA <input type="checkbox"/> OTHER <input type="checkbox"/>													Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		No. of Samples	Page of
Sampling		Type COM P	Matrix WATER SOIL AIR												CLIENT SAMPLE ID (9 CHARACTERS)		Login	LIMS Ver
Date	Time						REMARKS	LAB 1 ID	LAB 2 ID									
11/2/96			X	9 - BOTTOM	16354	2	SEAWATER											
				9 - <del>20</del> 90	355													
				9 - 60	356													
				9 - 30	357													
				9 - SURF	358													
				9A - BOTTOM	359													
				9A - 90	360													
				9A - 60	361													
				9A - 30	362													
				9A - SURF	363													
Sampled By & Time <i>[Signature]</i> 11/2/96		Date/Time		Relinquished By <i>[Signature]</i> 11/22/96		Date/Time		QC Level: 1 2 3 Other: _____										
Received By <i>M. Brown</i> 11/25/96		Date/Time		Relinquished By		Date/Time		COC Rec										
Received By		Date/Time		Relinquished By		Date/Time		ICE										
Received By		Date/Time		Relinquished By		Date/Time		Ana Req										
Received By		Date/Time		Relinquished By		Date/Time		TEMP										
Received By		Date/Time		Relinquished By		Date/Time		Cust Seal										
Received By		Date/Time		Relinquished By		Date/Time		Ph										
Work Authorized By		Date/Time		Shipped Via UPS BUS Fed-Ex Hand Other <i>DHL</i>		Shipping #												
Work Authorized By		Date/Time		Remarks TKH @ DL of 0.05 mg/L - NO TURBIDITY TEST														

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Page 1 of 2

CH2M Hill Project # 107091.WQ.96		Purchase Order #		LAB TEST CODES										SHADED AREA- FOR LAB USE ONLY					
Project Name JCO HARBOR MONITORING				# OF CONTAINERS										Lab 1 #		Lab 2 #			
Company Name/CH2M HILL Office CH2M HILL														Quote #		Kit Request #			
Project Manager & Phone # Mr. [ ] Ms. [ ] Dr. [ ]				Report Copy to:		ANALYSES REQUESTED										Project #			
Requested Completion Date:		Sampling Requirements SDWA <input type="checkbox"/> NDES <input checked="" type="checkbox"/> RCRA <input type="checkbox"/> OTHER <input type="checkbox"/>		Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		AMMONIA (352.1) NITRATE (353.1) NITRITE (353.1) TKN (351.3) @ DL of 0.05 mg/L TOTAL PHOSPHORUS (356.2)										No. of Samples		Page of	
Sampling		Type COM P GRAB		Matrix WATER SOIL AIR												CLIENT SAMPLE ID (9 CHARACTERS)		Login	
Date	Time							REMARKS		LAB 1 ID		LAB 2 ID							
11/25/96	2:46			X		10-BOTM	1636	2	X	X	X	X	SEAWATER						
						10-120	365												
						10-90	366												
						10-60	367												
						10-30	368												
						10-SURF	369												
						10A-BOTM	370												
						10A- <del>120</del>	90371												
						10A-60	372												
						10A-30	373												
						10A-SURF	374												
Sampled By & Title S. C. C. 11/24/96				Date/Time		Relinquished By S. C. C. 11/1/96				Date/Time		QC Level: 1 2 3 Other: _____							
Received By M. Brown				Date/Time 11/25/96		Relinquished By				Date/Time		COC Rec <input type="checkbox"/> ICE <input type="checkbox"/>							
Received By				Date/Time		Relinquished By				Date/Time		Ana Req <input type="checkbox"/> TEMP <input type="checkbox"/>							
Received By				Date/Time		Shipped Via UPS <input type="checkbox"/> BUS <input type="checkbox"/> Fed-Ex <input type="checkbox"/> Hand <input type="checkbox"/> Other <input checked="" type="checkbox"/> DHL				Shipping #									
Work Authorized By				Date/Time		Remarks TKN @ DL of 0.05 mg/L - NO TURBIDITY ON THESE													

CH2M HILL

## APPLIED SCIENCES LABORATORY

## CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

PAGE 1 of 2

CH2M Hill Project # 107091. WQ. 96		Purchase Order #		LAB TEST CODES										SHADED AREA- FOR LAB USE ONLY						
Project Name JCO HARBOR MONITORING				# OF CONTAINERS										Lab 1 #		Lab 2 #				
Company Name/CH2M HILL Office CH2M HILL														Quote #		Kit Request #				
Project Manager & Phone # Mr. [ ] STEVE COSTA Ms. [ ] Dr. [ ] 707-826-0717				Report Copy to:		ANALYSES REQUESTED										Project #				
Requested Completion Date:		Sampling Requirements SDWA <input type="checkbox"/> NPDES <input checked="" type="checkbox"/> RCRA <input type="checkbox"/> OTHER <input type="checkbox"/>		Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		AMMONIA (350.1) NITRATE (353.2) NITRITE (353.2) TKN (351.3) POLY 0.05 u/L TOTAL PHOSPHORUS 356.2										No. of Samples		Page of		
Sampling		Type COM GRAB WATER SOIL AIR		Matrix												CLIENT SAMPLE ID (9 CHARACTERS)		Login		LIMS Ver
Date	Time									REMARKS		LAB 1 ID		LAB 2 ID						
12/1/96				X		11	-	B	O	T	M	163752	X	X	X	X	X	SEAWATER		
						11	-	1	2	0		376								
						11	-	9	0			377								
						11	-	6	0			378								
						11	-	3	0			379								
						11	-	S	U	R	F	380								
						11	A	-	B	O	T	M	381							
						11	A	-	9	0		382								
						11	A	-	6	0		383								
						11	A	-	3	0		384								
						11	A	-	S	U	R	F	385							
Sampled By & Title (Please sign and print name) S. Costa		Date/Time 11/20/96		Relinquished By (Please sign and print name) S. Costa		Date/Time 11/22/96		QC Level: 1 2 3 Other: _____												
Received By (Please sign and print name) M. Brown		Date/Time 11/25/96		Relinquished By (Please sign and print name)		Date/Time		COC Rec <input type="checkbox"/> ICE												
Received By (Please sign and print name)		Date/Time		Relinquished By (Please sign and print name)		Date/Time		Ana Req <input type="checkbox"/> TEMP												
Received By (Please sign and print name)		Date/Time		Shipped Via UPS BUS Fed-Ex Hand Other <u>DHL</u>		Shipping #		Cust Seal <input type="checkbox"/> Ph												
Work Authorized By (Please sign and print name)		Remarks TKN@DL of 0.05 u/L DO NOT RUN TURBIDITY ON THESE SAMPLES																		

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

PAGE 2 of 2

CH2M Hill Project # 107091.W9.96		Purchase Order #		LAB TEST CODES										SHADED AREA- FOR LAB USE ONLY						
Project Name JCO HARBOR MONITORING				# OF CONTAINERS	ANALYSES REQUESTED AMMONIA (35.1) NITRATE (35.2) NITRITE (35.2) TKN @ DL of 0.05 mg/l (35.3) TOTAL PHOSPHORUS (35.2)										Lab 1 #		Lab 2 #			
Company Name/CH2M Hill Office CH2M HILL															Quote #		Kit Request #			
Project Manager & Phone # Mr. [ ] STEVE COSTA Ms. [ ] Dr. [ ] 707-826-7662															Report Copy to:		Project #			
Requested Completion Date:		Sampling Requirements SDWA <input type="checkbox"/> NPDES <input checked="" type="checkbox"/> RCRA <input type="checkbox"/> OTHER <input type="checkbox"/>													Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		No. of Samples		Page of	
Sampling Date Time		Type COMP GRAB	Matrix WATER SOIL AIR												CLIENT SAMPLE ID (9 CHARACTERS)		Login		LIMS Ver	
					REMARKS										LAB 1 ID	LAB 2 ID				
11/20/96					SEA WATER															
12-30																				
12-SURF																				
13-BOTTOM																				
13-30																				
13-SURF																				
Sampled By & Time S. Costa 11/20/96				Date/Time	Relinquished By S. Costa 11/22/96				Date/Time	QC Level: 1 2 3 Other: _____										
Received By M. Brown				Date/Time 11/25/96	Relinquished By				Date/Time	COC Rec ICE										
Received By				Date/Time	Relinquished By				Date/Time	Ana Req TEMP										
Received By				Date/Time	Shipped Via UPS BUS Fed-Ex Hand Other DHL				Shipping #											
Work Authorized By				Remarks TKN @ DL of 0.05 mg/l - NO TURBIDITY ON THESE SAMPLES																



Project # <b>107091.WB.96</b>		Purchase Order #		<input type="checkbox"/> <b>LGN</b> One Innovation Drive, Suite C Alachua, FL 32615-9586 (904) 462-3050 FAX (904) 462-1670		<input type="checkbox"/> <b>LRO</b> 5090 Caterpillar Road Redding, CA 96003-1412 (916) 244-5227 FAX (916) 244-4109		<b>THIS AREA FOR LAB USE ONLY</b>				
Project Name <b>JCO HARBOR MONITORING</b>				<input type="checkbox"/> <b>LMG</b> 2567 Fairlane Drive Montgomery, AL 36116-1622 (334) 271-2440 FAX (334) 271-3428		<input type="checkbox"/> <b>LKW</b> Canviro Analytical Laboratories, Inc. 50 Bathurst Unit 12 Waterloo, Ontario, Canada N2V 2C5 (519) 747-2575 FAX (519) 747-3806		Lab #	Page	of		
Company Name <b>CH2M HILL</b>								Client Service		Price Source <b>A P Q S</b>		
Project Manager or Contact & Phone # <b>STEVE COSTA</b> <b>707-826-0717</b>				Report Copy to:				Acct Code		Test Group		
Requested Completion Date:		Site ID		Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>				Project Code		Ack. Gen.		
Sampling Date Time		Type COMP GRAB WATER SOIL		CLIENT SAMPLE ID (9 CHARACTERS)		QC ID (3 CHAR)		ANALYSES REQUESTED # OF CONTAINERS AMMONIA (350.1) NITRATE (353.2) NITRITE (353.2) TKN 351.3 DL 0.05mg/L TOTAL PHOSPHORUS (356.2) TURBIDITY (182U)		LIMS Ver	Login	Mult.
										COC Review		
								SAMPLE REMARKS		LAB 1 ID	LAB 2 ID	
11/16/96		X		14-BOTTOM		16392		2		SEAWATER		
				14-120		393						
				14-90		394						
				14-30		396395						
				14-SURF		397396						
				15-BOTTOM		398						
				15-60		399						
				15-30		400						
				15-SURF		401						
				14-60		16395						
				8A-SURF		16353						
Sampled By & Time <b>SKC</b> 11/21/96				Relinquished By <b>SKC</b> 11/22/96				Date/Time		HAZWARP/NESSA: Y N		
Received By <b>M. B...</b> 11/25/96				Relinquished By				Date/Time		EDATA: Y N		
Received By				Relinquished By				Date/Time		QC LEVEL 1 2 3 OTHER		
Received By				Shipped Via UPS Fed-Ex Other <b>DHL</b>				Shipping #		pH Ice		
Batch Remarks: <b>TKN DL of 0.05 mg/L</b>										Custody Seal Temp		



# CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Page 1 of 2

Project # <b>107091.09.96</b>		Purchase Order #		<input type="checkbox"/> LGN One Innovation Drive, Suite C Alachua, FL 32615-9586 (904) 462-3050 FAX (904) 462-1670		<input type="checkbox"/> LRD 5090 Caterpillar Road Redding, CA 96003-1412 (916) 244-5227 FAX (916) 244-4109		THIS AREA FOR LAB USE ONLY		
Project Name <b>JCO HARBOR MONITORING</b>				<input type="checkbox"/> LMG 2567 Fairlane Drive Montgomery, AL 36116-1622 (334) 271-2440 FAX (334) 271-3428		<input type="checkbox"/> LKW Canviro Analytical Laboratories, Inc. 50 Bathurst, Unit 12 Waterloo, Ontario, Canada N2V 2C5 (519) 747-2575 FAX (519) 747-3806		Lab #	Page	of
Company Name <b>CH2M HILL</b>								Client Service		Price Source <b>A P Q S</b>
Project Manager or Contact & Phone # <b>STEVE COSTA 707-826-0717</b>				Report Copy to:				Acct Code		Test Group
Requested Completion Date:		Site ID		Sample Disposal:				Project Code		Ack. Gen.
				Dispose <input type="checkbox"/> Return <input type="checkbox"/>				LIMS Ver		Login
								COC Review		Mult.
								SAMPLE REMARKS		LAB 1 ID
										LAB 2 ID

Sampling		Type	Matrix	CLIENT SAMPLE ID (9 CHARACTERS)	QC ID (3 CHAR)	# OF CONTAINERS	ANALYSES REQUESTED						LAB 1 ID	LAB 2 ID
Date	Time	COMP	GRAB				WATER	SOIL	AMMONIA (35A.1)	NITRATE (353.2)	NITRITE (353.2)	TKN QOL of 0.05 mg/l (351.3)		
11/24/96				X	16-BOTM	16402	2	X	X	X	X	X		
					16-120	403								
					16-90	404								
					16-60	16405								
					16-30	406								
					16-SURF	407								
					17-BOTM	408								
					17-30	409								
					17-SURF	410								
					18-BOTM	411								
					18-120	412								

Sampled By & Title <b>SR</b>		Date/Time <b>11/24/96</b>		Relinquished By <b>SR</b>		Date/Time <b>22 Nov 96</b>		HAZWARP/NESSA: Y N	
Received By <b>M. Blon</b>		Date/Time <b>11/25/96</b>		Relinquished By		Date/Time		EDATA: Y N	
Received By		Date/Time		Relinquished By		Date/Time		QC LEVEL 1 2 3 OTHER	
Received By		Date/Time		Shipped Via UPS Fed-Ex Other <b>DHL</b>		Shipping #		pH Ice	
Batch Remarks: <b>TKN DL of 0.05 mg/l</b>								Custody Seal Temp	





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CH2M HILL

## APPLIED SCIENCES LABORATORY

## CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091.WQ.96		Purchase Order #		LAB TEST CODES										SHADED AREA-- FOR LAB USE ONLY				
Project Name HARBOR WATER QUALITY				# O F C O N T A I N E R S  C H L O R O P H Y L L - A											Lab 1 #	Lab 2 #		
Company Name/CH2M HILL Office CH2M HILL															Quote #	Kit Request #		
Project Manager & Phone # Mr. [ ] STEVE COSTA Ms. [ ] Dr. [ ] 707-826-0717					Report Copy to:										Project #			
Requested Completion Date:		Sampling Requirements SDWA NPDES RCRA OTHER <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>												No. of Samples	Page of
																	Login	LIMS Ver
Sampling Date Time		Type C O M P	Matrix G R A B W A T E R S O I L A I R	CLIENT SAMPLE ID (9 CHARACTERS)										REMARKS		LAB 1 ID	LAB 2 ID	
11/20-23/96		XX		6-BOTM 6-120 6-90 6-60 6-30 6-SURF 6A-BOTM 6A-60 6A-30 6A-SURF 7-BOTM														
Sampled By & Title (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		QC Level: 1 2 3 Other: _____						
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		COC Rec ICE						
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		Ana Req TEMP						
Received By (Please sign and print name)				Date/Time		Shipped Via UPS BUS Fed-Ex Hand Other HAND				Shipping #				Cust Seal Ph				
Work Authorized By (Please sign and print name)				Remarks														

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APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # <b>107091 WQ.96</b>		Purchase Order #		LAB TEST CODES										SHADED AREA-- FOR LAB USE ONLY					
Project Name <b>HARBOR WATER QUALITY</b>														Lab 1 #		Lab 2 #			
														Quote #		Kit Request #			
Company Name/CH2M HILL Office <b>CH2M HILL</b>				ANALYSES REQUESTED										Project #					
Project Manager & Phone # Mr. <b>STEVE COSTA</b> Tel. <b>707-826-0717</b>		Report Copy to:																	
Requested Completion Date:		Sampling Requirements SDWA <input type="checkbox"/> NPDES <input checked="" type="checkbox"/> RCRA <input type="checkbox"/> OTHER <input type="checkbox"/>		Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>												No. of Samples		Page of	
																Login		LIMS Ver	
Sampling Date Time		Type C O M P	Matrix G R A B W A T E R S O I L A I R	CLIENT SAMPLE ID (9 CHARACTERS)										REMARKS		LAB 1 ID		LAB 2 ID	
11/20/96				CH2M HILL-a										1		X			
Sampled By & Title (Please sign and print name)		Date/Time		Relinquished By (Please sign and print name)										Date/Time		QC Level: 1 2 3 Other: _____			
Received By (Please sign and print name)		Date/Time		Relinquished By (Please sign and print name)										Date/Time					
Received By (Please sign and print name)		Date/Time		Relinquished By (Please sign and print name)										Date/Time		COC Rec		ICE	
Received By (Please sign and print name)		Date/Time		Shipped Via										Shipping #		Ana Req		TEMP	
Work Authorized By (Please sign and print name)		Remarks		UPS BUS Fed-Ex Hand Other <b>HAND</b>												Cust Seal		Ph	

CH2M

## APPLIED SCIENCES LABORATORY

## CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # <b>107091.WQ.96</b>		Purchase Order #		LAB TEST CODES										SHADED AREA-- FOR LAB USE ONLY								
Project Name <b>HARBOR WATER QUALITY</b>				# OF CONTAINERS <b>Chetophy 11-a</b>	ANALYSES REQUESTED										Lab 1 #		Lab 2 #					
Company Name/CH2M HILL Office <b>CH2M HILL</b>															Quote #		Kit Request #					
Project Manager & Phone # Mr. [ ] <b>STEVE COSTA</b> Ms. [ ] <b>707-826-0717</b> Dr. [ ]															Report Copy to:				Project #			
Requested Completion Date:		Sampling Requirements SDWA NPDES RCRA OTHER <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>													Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		No. of Samples		Page of			
Date		Time													Type COM P G R A B W A T E R S O I L A I R		Matrix		CLIENT SAMPLE ID (9 CHARACTERS)		Login	
11/20/96		23/96		XX				8A-120		1		X										
								8A-90														
								8A-60														
								8A-30														
								8A-SURF														
								9-BOTM														
								9- <del>120</del> 90														
								9-60														
								9-30														
								9-SURF														
								9A-BOTM														
Sampled By & Title (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		QC Level: 1 2 3 Other: _____										
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		COC Rec ICE										
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		Ana Req TEMP										
Received By (Please sign and print name)				Date/Time		Shipped Via				Shipping #		Cust Seal Ph										
Work Authorized By (Please sign and print name)				Date/Time		UPS BUS Fed-Ex Hand Other <b>HAND</b>																
Remarks																						

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## APPLIED SCIENCES LABORATORY

## CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # <b>107091.00.96</b>		Purchase Order #		LAB TEST CODES										SHADED AREA-- FOR LAB USE ONLY								
Project Name <b>HARBOR WATER QUALITY</b>				# O F C O N T A I N E R S											Lab 1 #		Lab 2 #					
Company Name/CH2M HILL Office <b>CH2M HILL</b>															Quote #		Kit Request #					
Project Manager & Phone # Mr. [ ] <b>Steve Costa</b> Ms. [ ] <b>707-826-0717</b> Dr. [ ]					Report Copy to:										Project #							
Requested Completion Date:		Sampling Requirements			Sample Disposal:												No. of Samples		Page of			
		SDWA NPDES RCRA OTHER <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			Dispose Return <input type="checkbox"/> <input type="checkbox"/>												Login		LIMS Ver			
Sampling		Type	Matrix	CLIENT SAMPLE ID (9 CHARACTERS)												REMARKS		LAB 1 ID	LAB 2 ID			
Date	Time	C O M P	G R A B	W A T E R	S O I L	A I R																
11/20/96	23:46	X	X				10A-90															
							10A-60															
							10A-30															
							10A-SURF															
							11A-BOTM															
							11A-90															
							11A-60															
							11A-30															
							11A-SURF															
							12-BOTM															
							12-30															
Sampled By & Title (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		QC Level: 1 2 3 Other: _____										
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		COC Rec ICE										
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		Ana Req TEMP										
Received By (Please sign and print name)				Date/Time		Shipped Via UPS BUS Fed-Ex Hand Other <b>HAND</b>				Shipping #												
Work Authorized By (Please sign and print name)				Remarks																		

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## APPLIED SCIENCES LABORATORY

## CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project # 107091-WQ-96		Purchase Order #		LAB TEST CODES										SHADED AREA-- FOR LAB USE ONLY								
Project Name HARBOR WATER QUALITY				# O F C O N T A I N E R S	ANALYSES REQUESTED CHLOROPHYLL-a										Lab 1 #		Lab 2 #					
Company Name/CH2M HILL Office CH2M HILL															Quote #		Kit Request #					
Project Manager & Phone # Mr. [ ] STEVE COSTA Mr. [ ] 707-826-0717 Dr. [ ]															Report Copy to:				Project #			
Requested Completion Date:		Sampling Requirements SDWA NPDES RCRA OTHER <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>													Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		No. of Samples		Page of			
Type COM P		Matrix G R A B W A T E R S O I L A I R													CLIENT SAMPLE ID (9 CHARACTERS)				Login		LIMS Ver	
Date	Time														REMARKS		LAB 1 ID	LAB 2 ID				
11/20-23/96		X	X		12-SURF		1	X														
					14-BOTM																	
					14-120																	
					14-90																	
					14-60																	
					14-30																	
					14-SURF																	
					17-BOTM																	
					17-30																	
					17-SURF																	
					5-BOTM																	
Sampled By & Title (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		QC Level: 1 2 3 Other: _____										
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		COC Rec ICE										
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		Ana Req TEMP										
Received By (Please sign and print name)				Date/Time		Shipped Via UPS BUS Fed-Ex Hand Other HAND				Shipping #				Cust Seal Ph								
Work Authorized By (Please sign and print name)				Remarks																		

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CH2M Hill Project # <b>107091-WQ-96</b>		Purchase Order #		LAB TEST CODES										SHADED AREA-- FOR LAB USE ONLY						
Project Name <b>HARBOR WATER QUALITY</b>				# OF CONTAINERS <b>CHLOROPHYLL</b>											Lab 1 #		Lab 2 #			
Company Name/CH2M HILL Office <b>CH2M HILL</b>															Quote #		Kit Request #			
Project Manager & Phone # Mr. [ ] <b>STEVE COSTA</b> Ms. [ ] Dr. [ ] <b>707-826-0917</b>					Report Copy to:										Project #					
Requested Completion Date:		Sampling Requirements SDWA <input type="checkbox"/> NPDES <input checked="" type="checkbox"/> RCRA <input type="checkbox"/> OTHER <input type="checkbox"/>			Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>												No. of Samples		Page of	
Sampling Date Time		Type C O M P	Matrix G R A B W A T E R S O I L A I R		CLIENT SAMPLE ID (9 CHARACTERS)										Login		LIMS Ver			
														REMARKS		LAB 1 ID		LAB 2 ID		
11/20-23/96		XX		11-BOTTOM	1	X														
				11-120																
				11-90																
				11-60																
				11-30																
				11-SURF																
				13-BOTTOM																
				13-30																
				13-SURF																
				15-BOTTOM																
				15-60																
Sampled By & Title (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		QC Level: 1 2 3 Other: _____								
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		COC Rec ICE								
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		Ana Req TEMP								
Received By (Please sign and print name)				Date/Time		Shipped Via				Shipping #		Cust Seal Ph								
Work Authorized By (Please sign and print name)				Date/Time		Remarks														

CH2M HILL

APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #										Purchase Order #										LAB TEST CODES										SHADED AREA-- FOR LAB USE ONLY															
Project Name										Company Name/CH2M HILL Office										Project Manager & Phone #										Report Copy to:										Lab 1 #		Lab 2 #			
Requested Completion Date:										Sampling Requirements										Sample Disposal:										Project #															
Type										Matrix										CLIENT SAMPLE ID (9 CHARACTERS)										No. of Samples		Page of													
Date										Time										C O M P										Login		LIMS Ver													
Date										Time										C O M P										REMARKS		LAB 1 ID		LAB 2 ID											
11/20-23/96										15-30										15-SURF										1		1													
										16-BOTTOM										16-120																									
										16-90										16-60																									
										16-30										16-SURF																									
										18-BOTTOM										18-120																									
										18-90																																			
Sampled By & Title										Date/Time										Relinquished By										Date/Time										QC Level: 1 2 3 Other:					
Received By										Date/Time										Relinquished By										Date/Time										COC Rec				ICE	
Received By										Date/Time										Relinquished By										Date/Time										Ana Req				TEMP	
Received By										Date/Time										Shipped Via										Shipping #										Cust Seal				Ph	
Work Authorized By										Date/Time										Remarks																									

**CH2M HILL**  
**APPLIED SCIENCES LABORATORY**

**CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES**

CH2M Hill Project # <b>102091-009-96</b>		Purchase Order #		<b>LAB TEST CODES</b>										<b>SHADED AREA - FOR LAB USE ONLY</b>									
Project Name <b>HARBOR WATER QUALITY</b>														Lab 1 #		Lab 2 #							
														Quote #		Kit Request #							
Company Name/CH2M HILL Office <b>CH2M HILL</b>				<b>ANALYSES REQUESTED</b>										Project #									
Project Manager & Phone # Mr. [ ] <b>STEVE COSTA</b> Ms. [ ] Dr. [ ] <b>707-826-0717</b>		Report Copy to:																					
Requested Completion Date:		Sampling Requirements SDWA NPDES RCRA OTHER <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>												No. of Samples		Page of					
																Login		LIMS Ver					
Sampling Date Time		Type COM P GRA B WATER SOIL AIR		Matrix CLIENT SAMPLE ID (9 CHARACTERS)		<b>CHLOROPHYLL a</b>										REMARKS		LAB 1 ID	LAB 2 ID				
-11/20-23/96		XX		18-60		4	X	<div style="border: 1px solid black; border-radius: 50%; padding: 20px; display: inline-block;"> <b>NOTE: 102 SAMPLES TOTAL COUNT</b> </div>															
				18-30														L	L				
				18-SURF																			
Sampled By & Title (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time		QC Level: 1 2 3 Other: _____											
Received By (Please sign and print name) <b>MP. Wilson</b>				Date/Time <b>11/25/96 1200</b>		Relinquished By (Please sign and print name) <b>MP. Wilson</b>				Date/Time <b>11/27/96 1030</b>		COC Rec <input checked="" type="checkbox"/> ICE											
Received By (Please sign and print name) <b>M. Brown</b>				Date/Time <b>11/27</b>		Relinquished By (Please sign and print name)				Date/Time		Ana Req <input checked="" type="checkbox"/> TEMP											
Received By (Please sign and print name)				Date/Time		Shipped Via UPS BUS Fed-Ex Hand Other <b>HAND</b>				Shipping #		Cust Seal: Ph											
Work Authorized By (Please sign and print name)				Remarks																			



16.5, 14.5°C

Project # 107091. WQ. 96		Purchase Order #		<input type="checkbox"/> LGN One Innovation Drive, Suite C Alachua, FL 32615-9586 (904) 462-3050 FAX (904) 462-1670		<input type="checkbox"/> LRD 5090 Caterpillar Road Redding, CA 96003-1412 (916) 244-5227 FAX (916) 244-4109		THIS AREA FOR LAB USE ONLY			
Project Name JCO HARBOR W/Q STUDY				<input type="checkbox"/> LMG 2567 Fairlane Drive Montgomery, AL 36116-1622 (334) 271-2440 FAX (334) 271-3428		<input type="checkbox"/> LKW Canviro Analytical Laboratories, Inc. 50 Bathurst, Unit 12 Waterloo, Ontario, Canada N2V 2C5 (519) 747-2575 FAX (519) 747-3806		Lab #		Page of	
Company Name CH2M HILL				Report Copy to: David Wilson (Seattle)		ANALYSES REQUESTED PER YOUR QUOTATION FOR CO @ 12ug/L FOR ZINC @ 2ug/L		Client Service		Price Source A P Q S	
Project Manager or Contact & Phone # STEVE COSTA 707-826-0717				Requested Completion Date:		Site ID		Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		Acct Code	
Sampling Date		Time		Type COMP		Matrix GRA B WATER SOIL		CLIENT SAMPLE ID (9 CHARACTERS)		QC ID (3 CHAR)	
11/21						X		15-30		2	
								15-60		X	
								15-BOTTOM		X	
								16-30			
								16-120			
								16-BOTTOM			
								18-30			
								18-120			
								18-BOTTOM			
Sampled By & Title (Please sign and print name)				Date/Time 11/16		Relinquished By (Please sign and print name)				Date/Time 11/22/96	
Received By (Please sign and print name)				Date/Time 11-25-96 1600		Relinquished By (Please sign and print name)				Date/Time	
Received By (Please sign and print name)				Date/Time		Relinquished By (Please sign and print name)				Date/Time	
Received By (Please sign and print name)				Date/Time		Shipped Via UPS Fed-Ex Other DHL				Shipping #	
Batch Remarks: SEAWATER - HOLD SECOND CONTAINER FOR POSSIBLE ADDITIONAL TESTING										HAZWRAP/NESSA: Y N	
										EDATA: Y N	
										QC LEVEL 1 2 3 OTHER	
										pH	
										Custody Seal	
										Ice	
										Temp	

**Instructions and Agreement Provisions on Reverse Side**

**DISTRIBUTION:** Original - LAB, Yellow - LAB, Pink - Client  
REV 5/95 LAB FORM 340



QUALITY ANALYTICAL  
LABORATORIES, INC.

# CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

Q078

Project # <b>107091.WQ.96</b>		Purchase Order #		<input type="checkbox"/> LGN One Innovation Drive, Suite C Alachua, FL 32615-9586 (904) 462-3050 FAX (904) 462-1670		<input type="checkbox"/> LRD 5090 Caterpillar Road Redding, CA 96003-1412 (916) 244-5227 FAX (916) 244-4109		THIS AREA FOR LAB USE ONLY															
Project Name <b>JCO HARBOR W/Q STUDY</b>				<input type="checkbox"/> LMG 2567 Fairlane Drive Montgomery, AL 36116-1622 (334) 271-2440 FAX (334) 271-3428		<input type="checkbox"/> LKW Canviro Analytical Laboratories, Inc. 50 Bathurst, Unit 12 Waterloo, Ontario, Canada N2V 2C5 (519) 747-2575 FAX (519) 747-3806		Lab #		Page	of												
Company Name <b>CH2M HILL</b>				Project Manager or Contact & Phone # <b>STEVE COSTA</b> <b>707-826-0717</b>		Report Copy to:		Client Service		Price Source <b>A P Q S</b>													
Requested Completion Date:		Site ID		Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		ANALYSES REQUESTED <b>PER YOUR QUOTATION FOR CU@L244/L FOR ZN@L244/L</b>		Acct Code		Test Group													
Sampling <b>1996</b>		Type COM P GRA B WATER SOIL		Matrix				Project Code		Ack. Gen.													
Date		Time		CLIENT SAMPLE ID (9 CHARACTERS)		QC ID (3 CHAR)		LIMS Ver		Login		Mult.											
11/21				5-30				COC Review		LAB 1 ID		LAB 2 ID											
11/20				5-120				SAMPLE REMARKS		SEE BELOW													
				5-BOTTOM																			
				5A-30																			
				5A-120																			
				5A-BOTTOM																			
				11-30																			
				11-120																			
				11-BOTTOM																			
				13-SURF																			
				13-BOTTOM																			
Sampled By & Title <b>SA Costa</b> (Please sign and print name)				Date/Time <b>11/9/96</b>				Relinquished By <b>SA Costa</b> (Please sign and print name)				Date/Time <b>11/22/96</b>				HAZWRAP/NESSA: Y N							
Received By <b>JASON SOVERA</b> (Please sign and print name)				Date/Time <b>11-25-96 1600</b>				Relinquished By				Date/Time				EDATA: Y N							
Received By				Date/Time				Relinquished By				Date/Time				QC LEVEL 1 2 3 OTHER							
Received By				Date/Time				Shipped Via UPS Fed-Ex Other <b>DHL</b>				Shipping #				pH				Ice			
																Custody Seal				Temp			
Batch Remarks: <b>SEAWATER: HOLD SECOND CONTAINER FOR POSSIBLE ADDITIONAL TESTING</b>																							

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client  
REV 5 95 LAB FORM 340

## **Appendix V**

### **Laboratory Report for Nutrients and Biological Parameters**



## ANALYSIS REPORT

CH2M Hill  
PO Box 91500  
Bellevue, WA 98009-2050  
Attention: Steve Costa

Date Received: 11/25/96  
Date Reported: 12/11/96

AmTest Inc  
Professional  
Analytical  
Services  
14603 N.E. 87th St  
Redmond, WA  
98052  
Fax: 206 883 3495  
Tel: 206 885 1654

Project Name: JCO Harbor Mont.  
Project #: 107091.WQ.96  
Date Sampled: 11/21/96

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016315</b>		
<b>Client ID: 5-BOTTOM</b>		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.12
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.028
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.013
<b>96-A016316</b>		
<b>Client ID: 5-120</b>		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.13
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.092
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.011
<b>96-A016317</b>		
<b>Client ID: 5-90</b>		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.066
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	< 0.005
<b>96-A016318</b>		
<b>Client ID: 5-60</b>		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.049
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.014

# AMTEST

## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Date Reported: 12/11/96

Attention: Steve Costa

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016319</b>		
<b>Client ID: 5-30</b>		
Chlorophyll a	mg/m3	0.22
Pheophytin	mg/m3	0.09
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
<b>96-A016320</b>		
<b>Client ID: 5-SURF</b>		
Chlorophyll a	mg/m3	0.25
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.028
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
<b>96-A016321</b>		
<b>Client ID: 5A-BOTTOM</b>		
Chlorophyll a	mg/m3	0.36
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.010
<b>96-A016322</b>		
<b>Client ID: 5A-120</b>		
Chlorophyll a	mg/m3	0.47
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009





## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Date Reported: 12/11/96

Attention: Steve Costa

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016323</b>		
<b>Client ID: 5A-90</b>		
Chlorophyll a	mg/m3	0.49
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.043
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.011
<b>96-A016324</b>		
<b>Client ID: 5A-60</b>		
Chlorophyll a	mg/m3	0.71
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.093
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.012
<b>96-A016325</b>		
<b>Client ID: 5A-30</b>		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.060
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.013
<b>96-A016326</b>		
<b>Client ID: 5A-SURF</b>		
Chlorophyll a	mg/m3	0.34
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.071
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.005



# ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Date Reported: 12/11/96

Attention: Steve Costa

## Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016327</b>		
Client ID: 6-BOTTOM		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.047
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.010
<b>96-A016328</b>		
Client ID: 6-120		
Chlorophyll a	mg/m3	0.34
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.039
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.010
Total Phosphorus	mg/l	0.007
<b>96-A016329</b>		
Client ID: 6-90		
Chlorophyll a	mg/m3	0.57
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.005
Total Phosphorus	mg/l	0.014
<b>96-A016330</b>		
Client ID: 6-60		
Chlorophyll a	mg/m3	0.96
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.029
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.009



## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Attention: Steve Costa

Date Reported: 12/11/96

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016331</b>		
<b>Client ID: 6-30</b>		
Chlorophyll a	mg/m3	2.0
Pheophytin	mg/m3	0.14
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.097
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	0.016
<b>96-A016332</b>		
<b>Client ID: 6-SURF</b>		
Chlorophyll a	mg/m3	1.8
Pheophytin	mg/m3	0.39
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.063
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	0.008
<b>96-A016333</b>		
<b>Client ID: 6A-BOTTOM</b>		
Chlorophyll a	mg/m3	0.78
Pheophytin	mg/m3	0.31
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
<b>96-A016334</b>		
<b>Client ID: 6A-60</b>		
Chlorophyll a	mg/m3	1.5
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.068
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.012



## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Attention: Steve Costa

Date Reported: 12/11/96

## Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016335</b>		
Client ID: 6A-30		
Chlorophyll a	mg/m3	1.6
Pheophytin	mg/m3	0.38
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.10
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
<b>96-A016336</b>		
Client ID: 6A-SURF		
Chlorophyll a	mg/m3	1.3
Pheophytin	mg/m3	0.35
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.039
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.009
<b>96-A016337</b>		
Client ID: 7-BOTTOM		
Chlorophyll a	mg/m3	0.61
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.051
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.024
<b>96-A016338</b>		
Client ID: 7-90		
Chlorophyll a	mg/m3	1.3
Pheophytin	mg/m3	0.11
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.12
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.016



## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Date Reported: 12/11/96

Attention: Steve Costa

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016339</b>		
<b>Client ID: 7-60</b>		
Chlorophyll a	mg/m3	1.1
Pheophytin	mg/m3	0.26
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.028
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.005
Total Phosphorus	mg/l	0.016
<b>96-A016340</b>		
<b>Client ID: 7-30</b>		
Chlorophyll a	mg/m3	1.3
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.005
Total Nitrogen	mg/l	0.035
Nitrate + Nitrite	mg/l	0.012
Nitrite Nitrogen	mg/l	0.012
Total Phosphorus	mg/l	0.020
<b>96-A016341</b>		
<b>Client ID: 7-SURF</b>		
Chlorophyll a	mg/m3	1.6
Pheophytin	mg/m3	0.49
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.019
<b>96-A016342</b>		
<b>Client ID: 8-BOTTOM</b>		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	< 0.01

# AMTEST

## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Date Reported: 12/11/96

Attention: Steve Costa

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016343</b>		
Client ID: 8-120		
Chlorophyll a	mg/m3	0.36
Pheophytin	mg/m3	0.15
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.022
Turbidity	NTU	< 0.01
<b>96-A016344</b>		
Client ID: 8-90		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.01
<b>96-A016345</b>		
Client ID: 8-60		
Chlorophyll a	mg/m3	0.85
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.006
Total Nitrogen	mg/l	0.040
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.011
Total Phosphorus	mg/l	0.027
Turbidity	NTU	0.05
<b>96-A016346</b>		
Client ID: 8-30		
Chlorophyll a	mg/m3	2.7
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.09



## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Attention: Steve Costa

Date Reported: 12/11/96

## Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016347</b>		
Client ID: 8-SURF		
Chlorophyll a	mg/m3	2.0
Pheophytin	mg/m3	0.71
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.014
Turbidity	NTU	0.10
<b>96-A016348</b>		
Client ID: 8A-BOTTOM		
Chlorophyll a	mg/m3	0.24
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.014
Nitrite Nitrogen	mg/l	0.022
Total Phosphorus	mg/l	0.013
Turbidity	NTU	0.07
<b>96-A016349</b>		
Client ID: 8A-120		
Chlorophyll a	mg/m3	0.35
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	0.016
Turbidity	NTU	< 0.01
<b>96-A016350</b>		
Client ID: 8A-90		
Chlorophyll a	mg/m3	0.60
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.017
Turbidity	NTU	0.03



## ANALYSIS REPORT

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## Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016351</b>		
Client ID: 8A-60		
Chlorophyll a	mg/m3	0.96
Pheophytin	mg/m3	0.22
Ammonia Nitrogen	mg/l	0.10
Total Nitrogen	mg/l	0.17
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.008
Total Phosphorus	mg/l	0.065
Turbidity	NTU	0.27
<b>96-A016352</b>		
Client ID: 8A-30		
Chlorophyll a	mg/m3	1.9
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.10
Total Nitrogen	mg/l	0.15
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.006
Total Phosphorus	mg/l	0.062
Turbidity	NTU	0.24
<b>96-A016353</b>		
Client ID: 8A-SURF		
Chlorophyll a	mg/m3	1.2
Pheophytin	mg/m3	0.55
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.031
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.023
Turbidity	NTU	0.11
<b>96-A016354</b>		
Client ID: 9-BOTTOM		
Chlorophyll a	mg/m3	0.34
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.013
Nitrite Nitrogen	mg/l	0.016
Total Phosphorus	mg/l	0.024



# AMTEST

## ANALYSIS REPORT

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### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016355</b>		
<b>Client ID: 9-90</b>		
Chlorophyll a	mg/m3	0.36
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.008
Total Nitrogen	mg/l	0.056
Nitrate + Nitrite	mg/l	0.031
Nitrite Nitrogen	mg/l	0.029
Total Phosphorus	mg/l	0.030
<b>96-A016356</b>		
<b>Client ID: 9-60</b>		
Chlorophyll a	mg/m3	0.37
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.010
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.022
Nitrite Nitrogen	mg/l	0.030
Total Phosphorus	mg/l	0.031
<b>96-A016357</b>		
<b>Client ID: 9-30</b>		
Chlorophyll a	mg/m3	0.53
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.009
Total Nitrogen	mg/l	0.047
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.031
<b>96-A016358</b>		
<b>Client ID: 9-SURF</b>		
Chlorophyll a	mg/m3	0.35
Pheophytin	mg/m3	0.06
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.017
Total Phosphorus	mg/l	0.022



## ANALYSIS REPORT

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### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016359</b>		
Client ID: 9A-BOTTOM		
Chlorophyll a	mg/m3	0.31
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.019
<b>96-A016360</b>		
Client ID: 9A-90		
Chlorophyll a	mg/m3	0.34
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.016
Nitrite Nitrogen	mg/l	0.005
Total Phosphorus	mg/l	0.019
<b>96-A016361</b>		
Client ID: 9A-60		
Chlorophyll a	mg/m3	0.37
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.027
Total Phosphorus	mg/l	0.026
<b>96-A016362</b>		
Client ID: 9A-30		
Chlorophyll a	mg/m3	0.80
Pheophytin	mg/m3	0.08
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.018
Total Phosphorus	mg/l	0.022

# AMTEST

## ANALYSIS REPORT

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Attention: Steve Costa

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016363</b>		
<b>Client ID: 9A-SURF</b>		
Chlorophyll a	mg/m3	0.82
Pheophytin	mg/m3	0.08
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	0.018
<b>96-A016364</b>		
<b>Client ID: 10-BOTTOM</b>		
Chlorophyll a	mg/m3	0.49
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.014
<b>96-A016365</b>		
<b>Client ID: 10-120</b>		
Chlorophyll a	mg/m3	0.59
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.014
Total Phosphorus	mg/l	0.014
<b>96-A016366</b>		
<b>Client ID: 10-90</b>		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.030
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	0.012



## ANALYSIS REPORT

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### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016367</b>		
<b>Client ID: 10-60</b>		
Chlorophyll a	mg/m3	0.47
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.062
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.012
<b>96-A016368</b>		
<b>Client ID: 10-30</b>		
Chlorophyll a	mg/m3	0.69
Pheophytin	mg/m3	0.20
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.030
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.007
Total Phosphorus	mg/l	0.019
<b>96-A016369</b>		
<b>Client ID: 10-SURF</b>		
Chlorophyll a	mg/m3	0.74
Pheophytin	mg/m3	0.12
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.013
<b>96-A016370</b>		
<b>Client ID: 10A-BOTTOM</b>		
Chlorophyll a	mg/m3	0.50
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.007
Total Phosphorus	mg/l	0.014

## ANALYSIS REPORT

CH2M Hill

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## Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016371</b>		
<b>Client ID: 10A-90</b>		
Chlorophyll a	mg/m3	0.61
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.007
Total Phosphorus	mg/l	0.012
<b>96-A016372</b>		
<b>Client ID: 10A-60</b>		
Chlorophyll a	mg/m3	0.47
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.011
<b>96-A016373</b>		
<b>Client ID: 10A-30</b>		
Chlorophyll a	mg/m3	0.69
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.007
Total Phosphorus	mg/l	0.018
<b>96-A016374</b>		
<b>Client ID: 10A-SURF</b>		
Chlorophyll a	mg/m3	0.36
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.014



## ANALYSIS REPORT

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## Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016375</b>		
Client ID: 11-BOTTOM		
Chlorophyll a	mg/m3	0.41
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.014
Nitrite Nitrogen	mg/l	0.026
Total Phosphorus	mg/l	0.019
<b>96-A016376</b>		
Client ID: 11-120		
Chlorophyll a	mg/m3	0.29
Pheophytin	mg/m3	0.12
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.024
Total Phosphorus	mg/l	< 0.005
<b>96-A016377</b>		
Client ID: 11-90		
Chlorophyll a	mg/m3	0.43
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.029
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.008
Total Phosphorus	mg/l	< 0.005
<b>96-A016378</b>		
Client ID: 11-60		
Chlorophyll a	mg/m3	0.98
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.011
Nitrite Nitrogen	mg/l	0.021
Total Phosphorus	mg/l	0.012



## ANALYSIS REPORT

CH2M Hill

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### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016379</b>		
<b>Client ID: 11-30</b>		
Chlorophyll a	mg/m3	1.1
Pheophytin	mg/m3	0.09
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.006
Total Phosphorus	mg/l	0.011
<b>96-A016380</b>		
<b>Client ID: 11-SURF</b>		
Chlorophyll a	mg/m3	1.8
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.014
<b>96-A016381</b>		
<b>Client ID: 11A-BOTTOM</b>		
Chlorophyll a	mg/m3	0.24
Pheophytin	mg/m3	0.10
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.037
Nitrate + Nitrite	mg/l	0.018
Nitrite Nitrogen	mg/l	0.027
Total Phosphorus	mg/l	0.016
<b>96-A016382</b>		
<b>Client ID: 11A-90</b>		
Chlorophyll a	mg/m3	0.61
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.049
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.011
Total Phosphorus	mg/l	0.011

# AMTEST

## ANALYSIS REPORT

CH2M Hill

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Attention: Steve Costa

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016383</b>		
<b>Client ID: 11A-60</b>		
Chlorophyll a	mg/m3	0.60
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.13
Nitrate + Nitrite	mg/l	0.019
Nitrite Nitrogen	mg/l	0.023
Total Phosphorus	mg/l	0.011
<b>96-A016384</b>		
<b>Client ID: 11A-30</b>		
Chlorophyll a	mg/m3	1.4
Pheophytin	mg/m3	0.24
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.26
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.006
Total Phosphorus	mg/l	< 0.005
<b>96-A016385</b>		
<b>Client ID: 11A-SURF</b>		
Chlorophyll a	mg/m3	1.7
Pheophytin	mg/m3	0.05
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	< 0.005
<b>96-A016386</b>		
<b>Client ID: 12-BOTTOM</b>		
Chlorophyll a	mg/m3	0.35
Pheophytin	mg/m3	0.06
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.056
Nitrate + Nitrite	mg/l	0.027
Nitrite Nitrogen	mg/l	0.033
Total Phosphorus	mg/l	0.010





## ANALYSIS REPORT

CH2M Hill

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### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016387</b>		
Client ID: 12-30		
Chlorophyll a	mg/m3	1.0
Pheophytin	mg/m3	0.25
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.034
Nitrate + Nitrite	mg/l	0.011
Nitrite Nitrogen	mg/l	0.013
Total Phosphorus	mg/l	0.018
<b>96-A016388</b>		
Client ID: 12-SURF		
Chlorophyll a	mg/m3	1.9
Pheophytin	mg/m3	0.52
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.050
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	0.010
<b>96-A016389</b>		
Client ID: 13-BOTTOM		
Chlorophyll a	mg/m3	1.2
Pheophytin	mg/m3	0.31
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.013
Total Phosphorus	mg/l	0.016
<b>96-A016390</b>		
Client ID: 13-30		
Chlorophyll a	mg/m3	1.4
Pheophytin	mg/m3	0.23
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.005
Total Phosphorus	mg/l	0.014

# AMTEST

## ANALYSIS REPORT

CH2M Hill

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### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016391</b>		
Client ID: 13-SURF		
Chlorophyll a	mg/m3	3.7
Pheophytin	mg/m3	0.64
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.070
Nitrate + Nitrite	mg/l	0.024
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.025
<b>96-A016392</b>		
Client ID: 14-BOTTOM		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.13
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.038
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.021
Total Phosphorus	mg/l	0.021
Turbidity	NTU	0.11
<b>96-A016393</b>		
Client ID: 14-120		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.13
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.013
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.05
<b>96-A016394</b>		
Client ID: 14-90		
Chlorophyll a	mg/m3	0.60
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.006
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.04

# AMTEST

## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

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Attention: Steve Costa

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016395</b>		
<b>Client ID: 14-60</b>		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.016
Total Nitrogen	mg/l	0.042
Nitrate + Nitrite	mg/l	0.011
Nitrite Nitrogen	mg/l	0.013
Total Phosphorus	mg/l	0.017
Turbidity	NTU	0.07
<b>96-A016396</b>		
<b>Client ID: 14-30</b>		
Chlorophyll a	mg/m3	2.6
Pheophytin	mg/m3	0.17
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.15
<b>96-A016397</b>		
<b>Client ID: 14-SURF</b>		
Chlorophyll a	mg/m3	1.8
Pheophytin	mg/m3	0.47
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.009
Turbidity	NTU	0.14
<b>96-A016398</b>		
<b>Client ID: 15-BOTTOM</b>		
Chlorophyll a	mg/m3	0.49
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	0.015
Total Nitrogen	mg/l	0.031
Nitrate + Nitrite	mg/l	0.029
Nitrite Nitrogen	mg/l	0.028
Total Phosphorus	mg/l	0.020
Turbidity	NTU	0.06



## ANALYSIS REPORT

CH2M Hill

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Attention: Steve Costa

Date Reported: 12/11/96

## Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016399</b>		
Client ID: 15-60		
Chlorophyll a	mg/m3	0.84
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.013
Total Phosphorus	mg/l	0.014
Turbidity	NTU	0.03
<b>96-A016400</b>		
Client ID: 15-30		
Chlorophyll a	mg/m3	1.2
Pheophytin	mg/m3	0.23
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.009
Total Phosphorus	mg/l	0.018
Turbidity	NTU	0.09
<b>96-A016401</b>		
Client ID: 15-SURF		
Chlorophyll a	mg/m3	1.8
Pheophytin	mg/m3	0.14
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.016
Turbidity	NTU	0.20
<b>96-A016402</b>		
Client ID: 16-BOTTOM		
Chlorophyll a	mg/m3	0.12
Pheophytin	mg/m3	0.13
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.017
Nitrite Nitrogen	mg/l	0.028
Total Phosphorus	mg/l	0.018
Turbidity	NTU	0.20



# ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Attention: Steve Costa

Date Reported: 12/11/96

## Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016403</b>		
Client ID: 16-120		
Chlorophyll a	mg/m3	1.2
Pheophytin	mg/m3	0.40
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.011
Turbidity	NTU	0.16
<b>96-A016404</b>		
Client ID: 16-90		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.001
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.08
<b>96-A016405</b>		
Client ID: 16-60		
Chlorophyll a	mg/m3	0.24
Pheophytin	mg/m3	0.43
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	0.033
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	0.009
Turbidity	NTU	0.12
<b>96-A016406</b>		
Client ID: 16-30		
Chlorophyll a	mg/m3	1.6
Pheophytin	mg/m3	0.39
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.003
Total Phosphorus	mg/l	< 0.005
Turbidity	NTU	0.11



## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Attention: Steve Costa

Date Reported: 12/11/96

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016407</b>		
<b>Client ID: 16-SURF</b>		
Chlorophyll a	mg/m3	1.4
Pheophytin	mg/m3	0.07
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.002
Total Phosphorus	mg/l	0.017
Turbidity	NTU	0.18
<b>96-A016408</b>		
<b>Client ID: 17-BOTTOM</b>		
Chlorophyll a	mg/m3	0.74
Pheophytin	mg/m3	0.04
Ammonia Nitrogen	mg/l	0.044
Total Nitrogen	mg/l	0.12
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.012
Total Phosphorus	mg/l	0.048
Turbidity	NTU	0.21
<b>96-A016409</b>		
<b>Client ID: 17-30</b>		
Chlorophyll a	mg/m3	2.0
Pheophytin	mg/m3	0.47
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.018
Turbidity	NTU	0.22
<b>96-A016410</b>		
<b>Client ID: 17-SURF</b>		
Chlorophyll a	mg/m3	1.1
Pheophytin	mg/m3	0.44
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.013
Turbidity	NTU	0.19

# AMTEST

## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Date Reported: 12/11/96

Attention: Steve Costa

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016411</b>		
<b>Client ID: 18-BOTTOM</b>		
Chlorophyll a	mg/m3	0.24
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	0.012
Nitrite Nitrogen	mg/l	0.022
Total Phosphorus	mg/l	0.015
Turbidity	NTU	0.13
<b>96-A016412</b>		
<b>Client ID: 18-120</b>		
Chlorophyll a	mg/m3	0.48
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.010
Total Phosphorus	mg/l	0.026
Turbidity	NTU	0.08
<b>96-A016413</b>		
<b>Client ID: 18-90</b>		
Chlorophyll a	mg/m3	0.73
Pheophytin	mg/m3	0.04
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.004
Total Phosphorus	mg/l	0.018
Turbidity	NTU	0.08
<b>96-A016414</b>		
<b>Client ID: 18-60</b>		
Chlorophyll a	mg/m3	1.3
Pheophytin	mg/m3	< 0.03
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.006
Total Phosphorus	mg/l	0.019
Turbidity	NTU	0.14



## ANALYSIS REPORT

CH2M Hill

Date Received: 11/25/96

Date Reported: 12/11/96

Attention: Steve Costa

### Water Samples

PARAMETER	UNITS	RESULT
<b>96-A016415</b>		
<b>Client ID: 18-30</b>		
Chlorophyll a	mg/m3	1.5
Pheophytin	mg/m3	0.11
Ammonia Nitrogen	mg/l	0.009
Total Nitrogen	mg/l	0.049
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	0.010
Total Phosphorus	mg/l	0.020
Turbidity	NTU	0.33
<b>96-A016416</b>		
<b>Client ID: 18-SURF</b>		
Chlorophyll a	mg/m3	1.7
Pheophytin	mg/m3	0.17
Ammonia Nitrogen	mg/l	< 0.005
Total Nitrogen	mg/l	< 0.025
Nitrate + Nitrite	mg/l	< 0.01
Nitrite Nitrogen	mg/l	< 0.001
Total Phosphorus	mg/l	0.010
Turbidity	NTU	0.13





# METHODOLOGY REPORT

AM TEST ID 96-A016315  
CLIENT ID 5-BOTTOM

MATRIX : Water  
SAMPLED: 11/21/96

ANALYTE	UNITS	METHOD NUMBER	METHOD REFERENCE	DETECTION LIMIT *	DATE OF ANALYSIS
Chlorophyll a	mg/m3	1002G	SM	0.03	12/ 2/96
Pheophytin	mg/m3	1002G	SM	0.03	12/ 2/96
Ammonia Nitrogen	mg/l	350.1	EPA	0.005	11/27/96
Total Nitrogen	mg/l	351.3M	EPA	0.025	12/ 9/96
Nitrate + Nitrite	mg/l	353.2	EPA	0.010	11/26/96
Nitrite Nitrogen	mg/l	354.1	EPA	0.001	11/25/96
Total Phosphorus	mg/l	365.2	EPA	0.005	12/ 6/96

SM = Standard Methods for the Examination of Water and Wastewater 18th ed.  
SW-846 = Test Methods for Evaluating Solid Waste Physical/Chemical Methods  
EPA = Methods for Chemical Analysis of Water and Wastes 1983  
\* Instrument Detection Limit

## Quality Control Summary

QC for 96-A016315 - 96-A016416

DUPLICATES		sample value	duplicate value	RPD %
96-A016315 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016325 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016335 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016345 DUP: Ammonia Nitrogen	mg/l	0.006	0.012	67.
96-A016355 DUP: Ammonia Nitrogen	mg/l	0.008	0.007	13.
96-A016365 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016375 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016385 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016395 DUP: Ammonia Nitrogen	mg/l	0.016	0.012	29.
96-A016405 DUP: Ammonia Nitrogen	mg/l	< 0.005	< 0.005	
96-A016415 DUP: Ammonia Nitrogen	mg/l	0.009	< 0.005	
96-A016315 DUP: Total Nitrogen	mg/l	0.028	0.033	16.
96-A016325 DUP: Total Nitrogen	mg/l	0.060	0.048	22.
96-A016335 DUP: Total Nitrogen	mg/l	0.10	0.095	5.1
96-A016345 DUP: Total Nitrogen	mg/l	0.040	0.040	0.00
96-A016355 DUP: Total Nitrogen	mg/l	0.056	0.052	7.4
96-A016365 DUP: Total Nitrogen	mg/l	< 0.025	< 0.025	
96-A016375 DUP: Total Nitrogen	mg/l	< 0.025	< 0.025	
96-A016385 DUP: Total Nitrogen	mg/l	< 0.025	< 0.025	
96-A016395 DUP: Total Nitrogen	mg/l	0.042	0.037	13.
96-A016405 DUP: Total Nitrogen	mg/l	0.033	< 0.025	
96-A016415 DUP: Total Nitrogen	mg/l	0.049	0.035	33.
96-A016315 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016325 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016335 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016345 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016355 DUP: Nitrate + Nitrite	mg/l	0.031	0.031	0.00
96-A016365 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016375 DUP: Nitrate + Nitrite	mg/l	0.014	0.014	0.00
96-A016385 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016395 DUP: Nitrate + Nitrite	mg/l	0.011	0.013	17.
96-A016405 DUP: Nitrate + Nitrite	mg/l	< 0.01	< 0.01	
96-A016415 DUP: Nitrate + Nitrite	mg/l	< 0.01	0.010	
96-A016315 DUP: Nitrite Nitrogen	mg/l	0.009	0.006	40.
96-A016325 DUP: Nitrite Nitrogen	mg/l	< 0.001	< 0.001	
96-A016335 DUP: Nitrite Nitrogen	mg/l	0.001	< 0.001	
96-A016345 DUP: Nitrite Nitrogen	mg/l	0.011	0.010	9.5
96-A016355 DUP: Nitrite Nitrogen	mg/l	0.029	0.030	3.4
96-A016365 DUP: Nitrite Nitrogen	mg/l	0.014	0.014	0.00
96-A016375 DUP: Nitrite Nitrogen	mg/l	0.026	0.025	3.9
96-A016385 DUP: Nitrite Nitrogen	mg/l	0.002	0.001	67.
96-A016395 DUP: Nitrite Nitrogen	mg/l	0.013	0.012	8.0
96-A016405 DUP: Nitrite Nitrogen	mg/l	0.004	0.002	67.
96-A016415 DUP: Nitrite Nitrogen	mg/l	0.010	0.010	0.00

## Quality Control Summary (continued)

QC for 96-A016315 - 96-A016416

96-A016315 DUP: Total Phosphorus	mg/l	0.013	0.014	7.4
96-A016325 DUP: Total Phosphorus	mg/l	0.013	0.011	17.
96-A016335 DUP: Total Phosphorus	mg/l	0.009	0.013	36.
96-A016345 DUP: Total Phosphorus	mg/l	0.027	0.031	14.
96-A016355 DUP: Total Phosphorus	mg/l	0.030	0.036	18.
96-A016365 DUP: Total Phosphorus	mg/l	0.014	0.009	43.
96-A016375 DUP: Total Phosphorus	mg/l	0.019	0.012	45.
96-A016385 DUP: Total Phosphorus	mg/l	< 0.005	0.007	
96-A016395 DUP: Total Phosphorus	mg/l	0.017	0.017	0.00
96-A016405 DUP: Total Phosphorus	mg/l	0.009	0.009	0.00
96-A016415 DUP: Total Phosphorus	mg/l	0.020	0.024	18.
96-A016345 DUP: Turbidity	NTU	0.05	0.05	0.00
96-A016395 DUP: Turbidity	NTU	0.07	0.08	13.
96-A016405 DUP: Turbidity	NTU	0.12	0.12	0.00
96-A016415 DUP: Turbidity	NTU	0.33	0.31	6.3

### MATRIX SPIKES

		sample value	sample+spk value	spike value	Recovery %
96-A016316 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.58	0.50	116.
96-A016326 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.57	0.50	114.
96-A016336 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.57	0.50	114.
96-A016346 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.55	0.50	110.
96-A016356 SPIKE: Ammonia Nitrogen	mg/l	0.010	0.49	0.50	96.0
96-A016366 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.55	0.50	110.
96-A016376 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.51	0.50	102.
96-A016386 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.52	0.50	104.
96-A016396 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.55	0.50	110.
96-A016406 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.52	0.50	104.
96-A016416 SPIKE: Ammonia Nitrogen	mg/l	< 0.005	0.53	0.50	106.
96-A016316 SPIKE: Total Nitrogen	mg/l	0.092	1.1	1.0	101.
96-A016326 SPIKE: Total Nitrogen	mg/l	0.071	1.1	1.0	103.
96-A016336 SPIKE: Total Nitrogen	mg/l	0.039	1.1	1.0	106.
96-A016346 SPIKE: Total Nitrogen	mg/l	< 0.025	1.0	1.0	100.
96-A016356 SPIKE: Total Nitrogen	mg/l	< 0.025	1.1	1.0	110.
96-A016366 SPIKE: Total Nitrogen	mg/l	0.030	1.1	1.0	107.
96-A016376 SPIKE: Total Nitrogen	mg/l	< 0.025	1.0	1.0	100.
96-A016386 SPIKE: Total Nitrogen	mg/l	0.056	1.1	1.0	104.
96-A016396 SPIKE: Total Nitrogen	mg/l	< 0.025	1.0	1.0	100.
96-A016406 SPIKE: Total Nitrogen	mg/l	< 0.025	1.0	1.0	100.
96-A016416 SPIKE: Total Nitrogen	mg/l	< 0.025	1.0	1.0	100.
96-A016316 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.50	0.50	100.
96-A016326 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.50	0.50	100.
96-A016336 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.49	0.50	98.0
96-A016346 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.51	0.50	102.
96-A016356 SPIKE: Nitrate + Nitrite	mg/l	0.022	0.51	0.50	97.5
96-A016366 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.52	0.50	104.
96-A016376 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.47	0.50	94.0
96-A016386 SPIKE: Nitrate + Nitrite	mg/l	0.027	0.53	0.50	101.
96-A016396 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.51	0.50	102.
96-A016406 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.50	0.50	100.
96-A016416 SPIKE: Nitrate + Nitrite	mg/l	< 0.01	0.49	0.50	98.0

## Quality Control Summary (continued)

QC for 96-A016315 - 96-A016416

96-A016316 SPIKE: Nitrite Nitrogen	mg/l	0.002	0.26	0.25	103.
96-A016326 SPIKE: Nitrite Nitrogen	mg/l	< 0.001	0.27	0.25	108.
96-A016336 SPIKE: Nitrite Nitrogen	mg/l	< 0.001	0.27	0.25	108.
96-A016346 SPIKE: Nitrite Nitrogen	mg/l	0.001	0.27	0.25	108.
96-A016356 SPIKE: Nitrite Nitrogen	mg/l	0.030	0.30	0.25	108.
96-A016366 SPIKE: Nitrite Nitrogen	mg/l	0.004	0.27	0.25	106.
96-A016376 SPIKE: Nitrite Nitrogen	mg/l	0.024	0.30	0.25	110.
96-A016386 SPIKE: Nitrite Nitrogen	mg/l	0.033	0.31	0.25	111.
96-A016396 SPIKE: Nitrite Nitrogen	mg/l	0.004	0.29	0.25	114.
96-A016406 SPIKE: Nitrite Nitrogen	mg/l	0.003	0.28	0.25	111.
96-A016416 SPIKE: Nitrite Nitrogen	mg/l	< 0.001	0.27	0.25	108.
96-A016316 SPIKE: Total Phosphorus	mg/l	0.011	0.20	0.20	94.5
96-A016326 SPIKE: Total Phosphorus	mg/l	0.005	0.21	0.20	102.
96-A016336 SPIKE: Total Phosphorus	mg/l	0.009	0.19	0.20	90.5
96-A016346 SPIKE: Total Phosphorus	mg/l	< 0.005	0.22	0.20	110.
96-A016356 SPIKE: Total Phosphorus	mg/l	0.031	0.22	0.20	94.5
96-A016366 SPIKE: Total Phosphorus	mg/l	0.012	0.19	0.20	89.0
96-A016376 SPIKE: Total Phosphorus	mg/l	< 0.005	0.20	0.20	100.
96-A016386 SPIKE: Total Phosphorus	mg/l	0.010	0.18	0.20	85.0
96-A016396 SPIKE: Total Phosphorus	mg/l	< 0.005	0.20	0.20	100.
96-A016406 SPIKE: Total Phosphorus	mg/l	< 0.005	0.19	0.20	95.0
96-A016416 SPIKE: Total Phosphorus	mg/l	0.010	0.20	0.20	95.0

### STANDARD REFERENCE MATERIALS

			measured	true	Recovery
			value	value	%
Known	SRM: Chlorophyll a	mg/m3	360	310	117.
Known	SRM: Chlorophyll a	mg/m3	360	310	117.
Known	SRM: Chlorophyll a	mg/m3	220	310	71.7
Known	SRM: Chlorophyll a	mg/m3	340	310	110.
Known	SRM: Chlorophyll a	mg/m3	310	310	100.
Known	SRM: Chlorophyll a	mg/m3	260	310	83.9
Known	SRM: Ammonia Nitrogen	mg/l	4.1	3.9	105.
Known	SRM: Ammonia Nitrogen	mg/l	4.1	3.9	105.
Known	SRM: Ammonia Nitrogen	mg/l	3.9	3.9	100.
Known	SRM: Ammonia Nitrogen	mg/l	4.1	3.9	105.
Known	SRM: Ammonia Nitrogen	mg/l	4.1	3.9	105.
Known	SRM: Ammonia Nitrogen	mg/l	3.8	3.9	97.4
Known	SRM: Ammonia Nitrogen	mg/l	3.8	3.9	97.4
Known	SRM: Ammonia Nitrogen	mg/l	3.4	3.9	87.2
Known	SRM: Ammonia Nitrogen	mg/l	3.7	3.9	94.9
Known	SRM: Ammonia Nitrogen	mg/l	4.0	3.9	103.
Known	SRM: Ammonia Nitrogen	mg/l	3.9	3.9	100.

## Quality Control Summary (continued)

QC for 96-A016315 - 96-A016416

Known	SRM: Total Nitrogen	mg/l	4.0	3.9	103.
Known	SRM: Total Nitrogen	mg/l	5.4	7.8	82.1
Known	SRM: Total Nitrogen	mg/l	6.7	7.8	85.9
Known	SRM: Total Nitrogen	mg/l	6.9	7.8	88.5
Known	SRM: Total Nitrogen	mg/l	6.9	7.8	80.5
Known	SRM: Total Nitrogen	mg/l	6.9	7.8	88.5
Known	SRM: Total Nitrogen	mg/l	3.9	4.1	94.2
Known	SRM: Total Nitrogen	mg/l	7.4	7.8	94.9
Known	SRM: Total Nitrogen	mg/l	7.2	7.8	92.3
Known	SRM: Total Nitrogen	mg/l	7.1	7.8	91.0
Known	SRM: Nitrate + Nitrite	mg/l	7.3	7.0	104.
Known	SRM: Nitrate + Nitrite	mg/l	6.9	7.0	98.6
Known	SRM: Nitrate + Nitrite	mg/l	7.0	7.0	100.
Known	SRM: Nitrate + Nitrite	mg/l	7.0	7.0	100.
Known	SRM: Nitrate + Nitrite	mg/l	6.5	7.0	92.9
Known	SRM: Nitrate + Nitrite	mg/l	6.9	7.0	98.6
Known	SRM: Nitrate + Nitrite	mg/l	6.9	7.0	98.6
Known	SRM: Nitrate + Nitrite	mg/l	6.9	7.0	98.6
Known	SRM: Nitrate + Nitrite	mg/l	6.9	7.0	98.6
Known	SRM: Nitrate + Nitrite	mg/l	6.8	7.0	97.1
Known	SRM: Nitrate + Nitrite	mg/l	6.8	7.0	97.1
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.44	0.44	100.
Known	SRM: Nitrite Nitrogen	mg/l	0.44	0.44	100.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Nitrite Nitrogen	mg/l	0.44	0.44	100.
Known	SRM: Nitrite Nitrogen	mg/l	0.44	0.44	100.
Known	SRM: Nitrite Nitrogen	mg/l	0.45	0.44	102.
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	2.0	1.9	105.
Known	SRM: Total Phosphorus	mg/l	1.9	1.9	100.
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Total Phosphorus	mg/l	1.6	1.9	84.2
Known	SRM: Total Phosphorus	mg/l	1.9	1.9	100.
Known	SRM: Total Phosphorus	mg/l	1.8	1.9	94.7
Known	SRM: Turbidity	NTU	1.2	1.3	92.3
Known	SRM: Turbidity	NTU	1.2	1.3	92.3
Known	SRM: Turbidity	NTU	1.3	1.3	100.
Known	SRM: Turbidity	NTU	1.3	1.3	100.

BLANKS

Result

# Quality Control Summary (continued)

QC for 96-A016315 - 96-A016416

BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Chlorophyll a	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Pheophytin	mg/m3	< 0.03
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Ammonia Nitrogen	mg/l	< 0.005
BLANK: Total Nitrogen	mg/l	< 0.025
BLANK: Total Nitrogen	mg/l	< 0.025
BLANK: Total Nitrogen	mg/l	< 0.025
BLANK: Total Nitrogen	mg/l	< 0.025
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrate + Nitrite	mg/l	< 0.01
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001
BLANK: Nitrite Nitrogen	mg/l	< 0.001

## Quality Control Summary (continued)

QC for 96-A016315 - 96-A016416

BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Total Phosphorus	mg/l	< 0.005
BLANK: Turbidity	NTU	< 0.01
BLANK: Turbidity	NTU	< 0.01
BLANK: Turbidity	NTU	0.02
BLANK: Turbidity	NTU	0.02

## **Appendix VI**

### **Laboratory Results for Zinc and Copper**





ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 15-30

Lab Sample ID: Q898A  
LIMS ID: 96-20204  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96  
Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:  
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 15-30  
Lab Sample ID: Q898A      QC Report No: Q898-CH2M Hill  
LIMS ID: 96-20204      Project: JCO Harbor W/Q Study  
Matrix: Water      107091.WQ.96  
Date Received: 11/25/96  
Data Release Authorized: *[Signature]*  
Reported: 12/17/96

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Spike mg/L	Spike Added	% Recovery	Q
Copper	0.002 U	0.000	0.000	NA	
Zinc	0.02 U	0.46	0.50	92.0%	

'Q' codes:      N = control limit not met  
                  H = %R not applicable, sample concentration too high  
                  \* = RPD control limit not met  
                  NA = Not applicable - analyte not spiked

Control Limits:      Percent Recovery: 75-125%  
                          RPD:                    +/-20%

FORM-V



ANALYTICAL  
RESOURCES  
INCORPORATED


INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 15-60

Lab Sample ID: Q898B  
LIMS ID: 96-20205  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized: 

Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Lab Sample ID: Q898B      Sample No: 15-60  
LIMS ID: 96-20205      QC Report No: Q898-CH2M Hill  
Matrix: Water      Project: JCO Harbor W/Q Study  
107091.WQ.96  
Date Received: 11/25/96  
Data Release Authorized: *[Signature]*  
Reported: 12/17/96

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Duplicate mg/L	RPD	Control Limit	Q
Zinc	0.02 U	0.02 U	0.0%	+/- 0.02	L

'Q' codes:

\* = control limit not met  
L = RPD not valid, alternate limit = detection limit



ANALYTICAL  
RESOURCES  
INCORPORATED

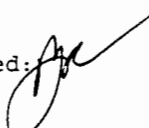
INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 15-Botm

Lab Sample ID: Q898C  
LIMS ID: 96-20206  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I




ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 16-30

Lab Sample ID: Q898D  
LIMS ID: 96-20207  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96  
Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Lab Sample ID: Q898D      Sample No: 16-30  
LIMS ID: 96-20207      QC Report No: Q898-CH2M Hill  
Matrix: Water      Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Received: 11/25/96

Data Release Authorized: *[Signature]*

Reported: 12/17/96

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Spike mg/L	Spike Added	% Recovery	Q
Copper	0.002 U	0.002	0.002	100%	
Zinc	0.02 U	0.00	0.00	NA	

'Q' codes:      N = control limit not met  
                  H = %R not applicable, sample concentration too high  
                  \* = RPD control limit not met  
                  NA = Not applicable - analyte not spiked

Control Limits:      Percent Recovery: 75-125%  
                          RPD: +/-20%

FORM-V




ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 16-120

Lab Sample ID: Q898E  
LIMS ID: 96-20208  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96  
Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I





ANALYTICAL  
RESOURCES  
INCORPORATED


INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 16-Botm

Lab Sample ID: Q898F  
LIMS ID: 96-20209  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED


INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 18-30

Lab Sample ID: Q898G  
LIMS ID: 96-20210  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL  
RL Reporting Limit

FORM-I



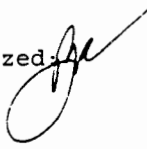
ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 18-120

Lab Sample ID: Q898H  
LIMS ID: 96-20211  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96  
Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL  
RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 18-Botm

Lab Sample ID: Q898I  
LIMS ID: 96-20212  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96  
Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized  
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I




ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 5-30

Lab Sample ID: Q898J  
LIMS ID: 96-20213  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor w/Q Study  
107091 WQ.96  
Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL  
RL Reporting Limit

FORM-I



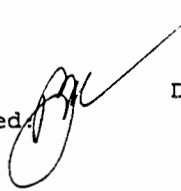
ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 5-120

Lab Sample ID: Q898K  
LIMS ID: 96-20214  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96  
Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED


INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 5-Botm

Lab Sample ID: Q898L  
LIMS ID: 96-20215  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 5A-30

Lab Sample ID: Q898M

LIMS ID: 96-20216

Matrix: Water

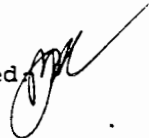
QC Report No: Q898-CH2M Hill

Project: JCO Harbor W/Q Study

107091.WQ.96

Date Sampled: 11/21/96

Date Received: 11/25/96

Data Release Authorized: 

Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I






ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 5A-120

Lab Sample ID: Q898N  
LIMS ID: 96-20217  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96  
Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED


INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 5A-Botm

Lab Sample ID: Q8980  
LIMS ID: 96-20218  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: 11/21/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED


INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 11-30

Lab Sample ID: Q898P  
LIMS ID: 96-20219  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: 11/20/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL  
RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED


INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 11-120

Lab Sample ID: Q898Q  
LIMS ID: 96-20220  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: 11/20/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED


INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 11-Botm

Lab Sample ID: Q898R  
LIMS ID: 96-20221  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: 11/20/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED

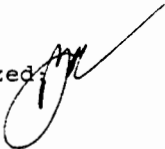
INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 13-Surf

Lab Sample ID: Q898S  
LIMS ID: 96-20222  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: 11/20/96  
Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: 13-Botm

Lab Sample ID: Q898T

QC Report No: Q898-CH2M Hill

LIMS ID: 96-20223


Project: JCO Harbor W/Q Study

Matrix: Water

107091.WQ.96

Date Sampled: 11/20/96

Date Received: 11/25/96

Data Release Authorized: 

Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	12/05/96	200.7	12/11/96	7440-50-8	Copper	0.002	0.002 U
200.7	12/05/96	200.7	12/11/96	7440-66-6	Zinc	0.02	0.02 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I




ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Lab Sample ID: Q898T  
LIMS ID: 96-20223  
Matrix: Water

Sample No: 13-Botm  
QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Received: 11/25/96

Data Release Authorized:   
Reported: 12/17/96

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Duplicate mg/L	RPD	Control Limit	Q
Copper	0.002 U	0.002 U	0.0%	+/- 0.002	L

'Q' codes:

\* = control limit not met

L = RPD not valid, alternate limit = detection limit

FORM-VI





ANALYTICAL  
RESOURCES  
INCORPORATED

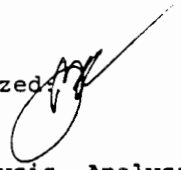
INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Sample No: Method Blank

Lab Sample ID: Q898MB  
LIMS ID: 96-20204  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Date Sampled: NA  
Date Received: NA

Data Release Authorized:   
Reported: 12/17/96

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7M	12/05/96	6010	12/11/96	7440-50-8	Copper	0.002	0.002 U
CLP	12/05/96	6010	12/11/96	7440-66-6	Zinc	0.004	0.004 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I



ANALYTICAL  
RESOURCES  
INCORPORATED

INORGANICS ANALYSIS DATA SHEET  
TOTAL METALS

Lab Sample ID: Q898LCS  
LIMS ID: 96-20205  
Matrix: Water

QC Report No: Q898-CH2M Hill  
Project: JCO Harbor W/Q Study  
107091.WQ.96

Data Release Authorized  
Reported: 12/13/96

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Spike mg/L	Spike Added	% Recovery	Q
Copper	0.229	0.250	91.6%	
Zinc	0.97	1.00	97.0%	

'Q' codes: N = control limit not met

Control Limits: 75-125%